DOCUMENT RESUME

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ABSTRACT

This is a teacher's manual for an ISS-based elementary school course in the metric system. Behavioral objectives and student activities are included. The topics covered include: (1) linear measurement; (2) metric-decimal relationships; (3) metric conversions; (4) geometry; (5) scale drawings; and (6) capacity. This is the first of a two-part manual. (BB)

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ELEMENTARY METRIC CURRICULUM

COMMUNITY SCHOOL DISTRICT # 18
BROOKLYN, NEW YORK

PROJECT T.I.M.E.
(TIMELY IMPLEMENTATION OF METRIC EDUCATION.)

NEW YORK STATE EDUCATION DEPARTMENT
E.S.A.A. TITLE 4C GRANT # 42-C77-13134 - 2 - DEV.

PART I

Office of the Community Superintendent
Community School District 18
755 East 100 Street
Brooklyn, N. Y. 11236
257-7500

SE 027 738

COMMUNITY SCHOOL DISTRICT # 18
BROOKLYN, NEW YORK

PROJECT T.I.M.E. - ESEA TITLE IV C
JUNIOR HIGH SCHOOL LEVEL METRIC PROGRAM.

SYSTEME INTERNATIONAL

HOWARD M. GOLDSTEIN
PROJECT COORDINATOR

METRIC
COORDINATORS

SEYMOUR BASHKOWITZ
GARY HERT
ELLIOTT KORB
RICHARD LEVY
ARNOLD MARCUS

PROJECT T.I.M.E. (TIMELY IMPLEMENTATION OF METRIC EDUCATION) A COMPONENT OF THE I.S.S. EDUCATIONAL SYSTEM.

Since 1976, Community School District # 18 has been at the forefront in the development and implementation of new methods and materials in secondary school metric education.

Throught a carefully managed program, Project T.I.M.E. the District has pursued its four major objectives(i.e., curriculum development, staff training, dissemination and demonstration), and has started to bring about a substantial and significant achievement of the project's objectives.

Since the inception of the program, instructional modules, activities and supportive materials were developed and disseminated for introducing metric concepts to students. Staff training workshops are being conducted with teaching personnel, I.S.S. Resource Persons and Title I remedial mathematics teachers(these workshops are structured with locally developed training materials). The District's metric newsletter (Metric News Hotline) is widely used, and an adult level "metrication Center"has been established and is operational.

As a result of this project:

- District # 18 junior high school teachers are demonstrating significantly increased motivation to teach the metric system.
- The District's junior high school teachers have significantly enhanced their qualifications to teach the metric system; and
- Our junior high school students are showing significant improvement in their knowledge of metric measurement.

Finally, successful implementation of Project T.I.M.E. exemplifies once again, the versatility of the district's Instructional Support System (I.S.S.)

CSD-18

ISS-BASED

MATHEMATICS PROGRAM

TEACHERS MANUAL

THE METRIC SYSTEM OF MEASUREMENT

1.10.11 LINEAR MEASUREMENT

INSTRUCTIONAL OBJECTIVES

NEW I.O.s	The student will be able to...
1.10.11.01	compare two or more objects as to: a) same (equivalent) length b) longer, longest; shorter, shortest
1.10.11.02	estimate the length and height of objects as: a) twice as long (high) b) half as long (high)
1.10.11.03	identify the meter stick as a measuring tool.

10

ACTIVITIES

1.10.11.01

METHOD

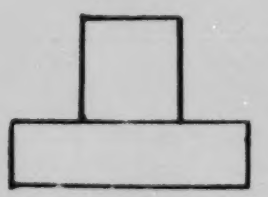
Teacher will hold up two objects of the same length and ask the children to tell what they observe about the lengths. (Both the same size). Then she can compare the height of two children. Who is shorter? Who is taller?

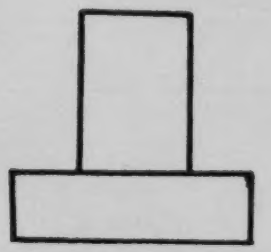
See p. 1b and 1c.

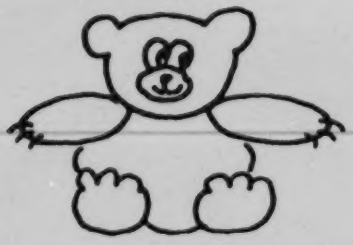
10

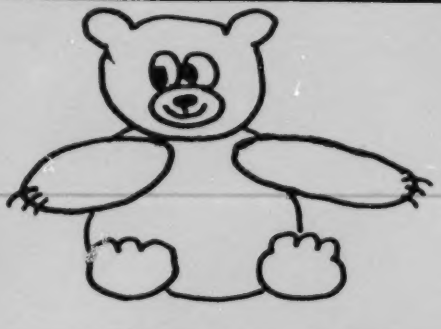
Name _____

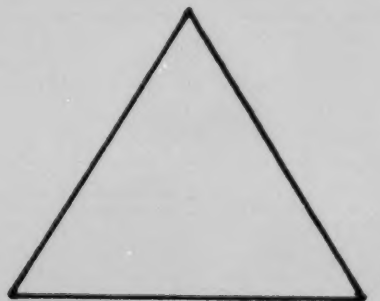
Which is shorter?







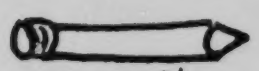
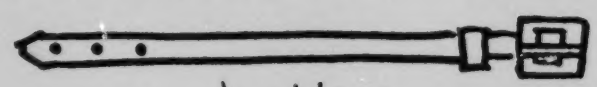


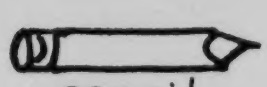


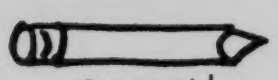
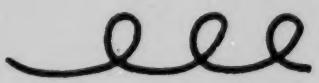
Name _____

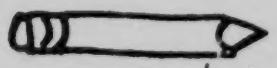
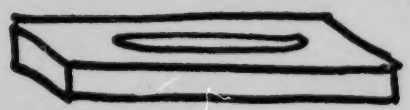
Which is longer?

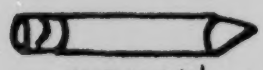
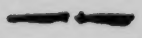
Circle the answers.

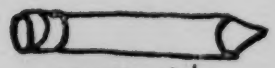
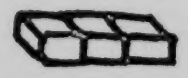
1.  pencil or  belt

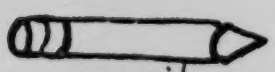
2.  pencil or spoon

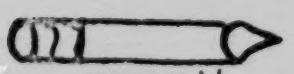
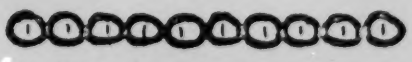
3.  pencil or  string

4.  pencil or  box

5.  pencil or  2 toothpicks

6.  pencil or  3 cubes

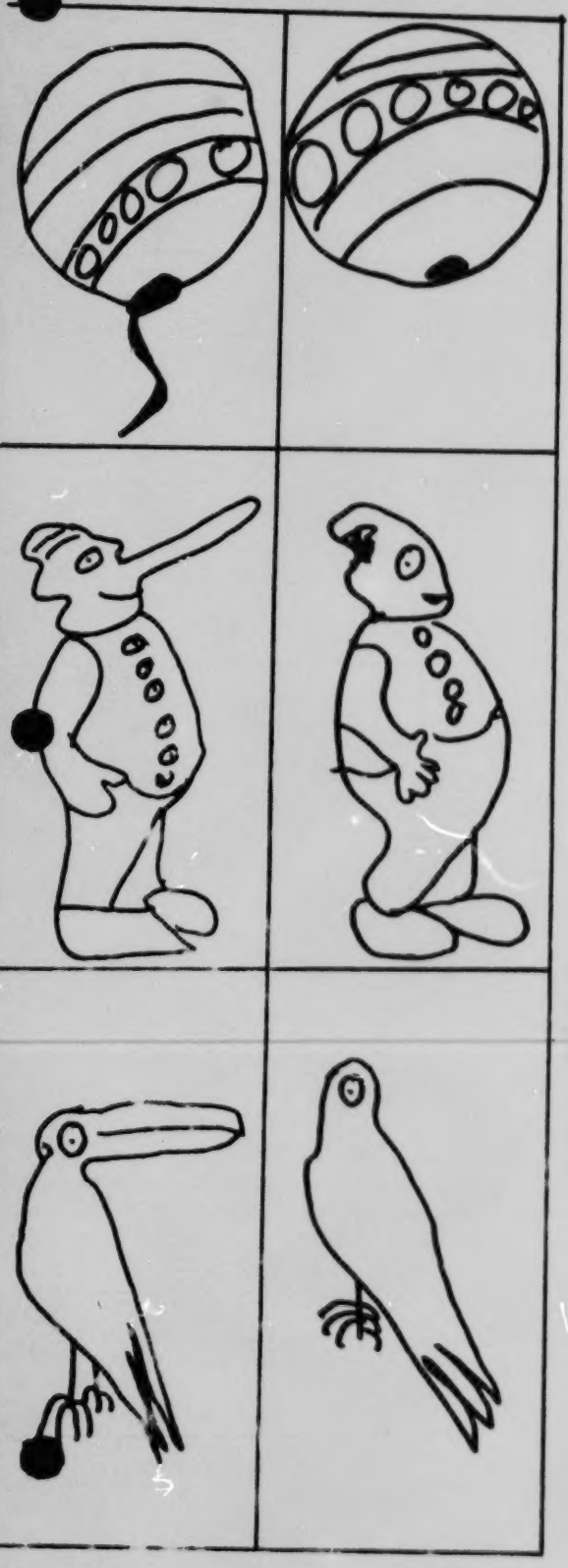
7.  pencil or leaf

8.  pencil or  10 pennies

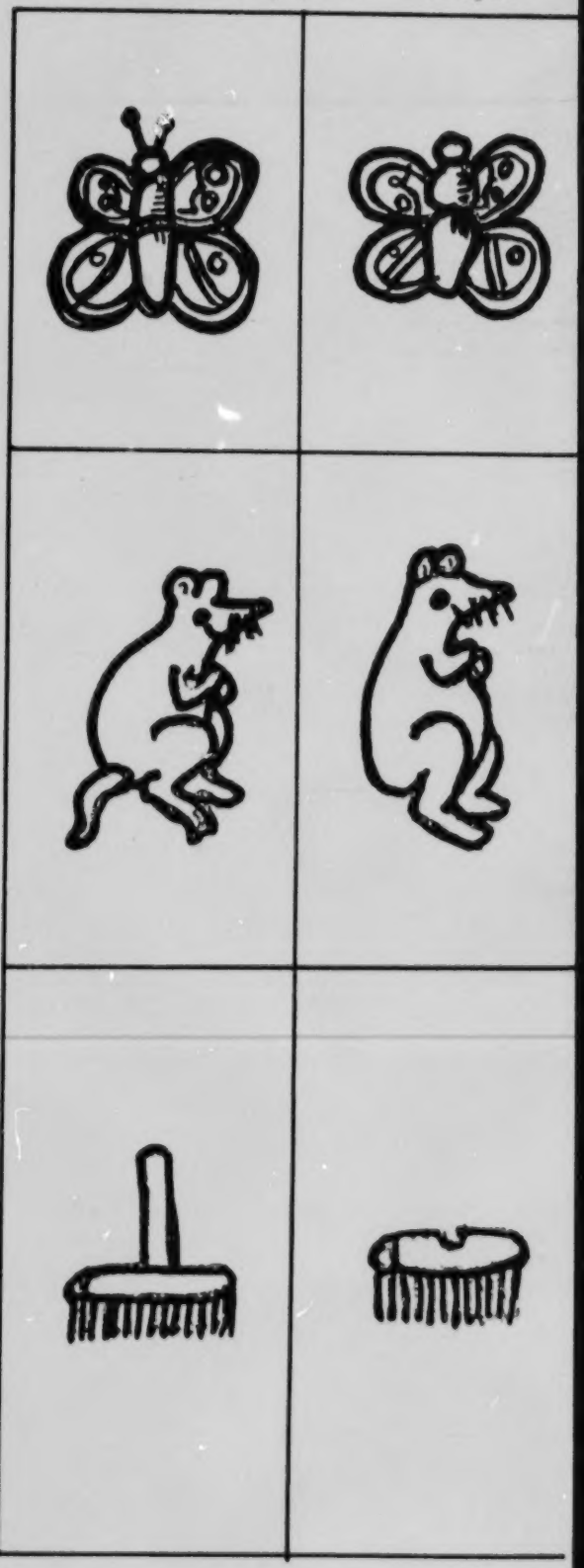
M-1c-

SHORTER - LONGER

Draw the missing part. Make it shorter

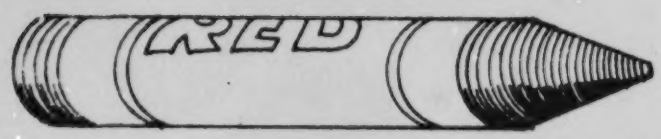


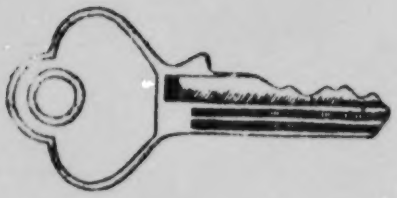
Draw the missing part - longer

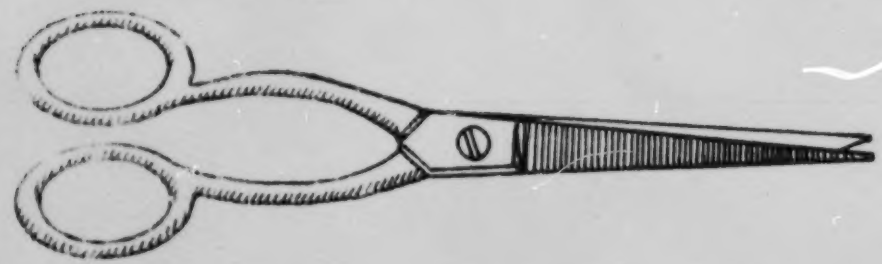


S.S. _____ NAME _____

DIRECTIONS: 1) MARK AN X ON THE LONGEST OBJECT.
2) MARK AN O ON THE SHORTEST OBJECT.
3) MARK A LINE THROUGH OBJECTS THAT ARE THE SAME SIZE.

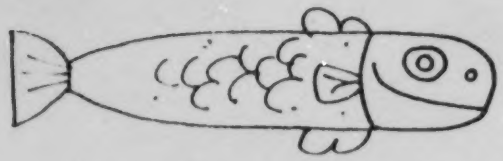


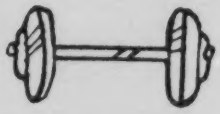


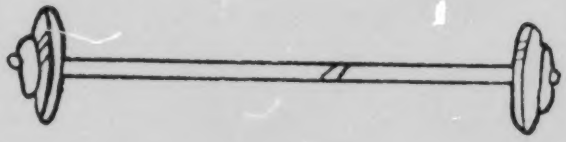


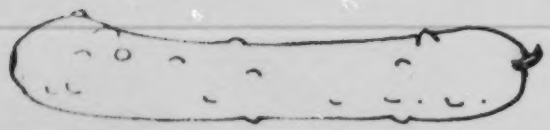
I.O. 1.10.11.01 NAME _____

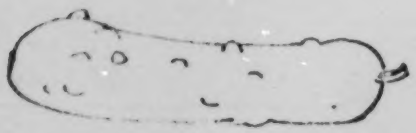
Mark the longest. X
Check the shortest. ✓

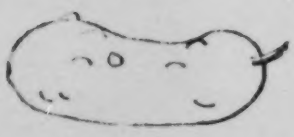


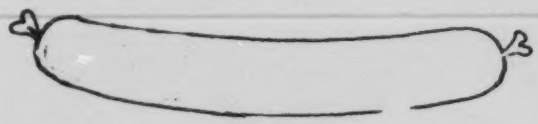


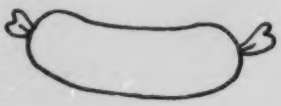


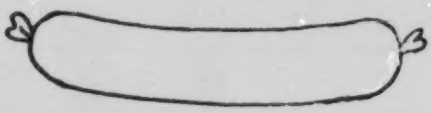












ACTIVITIES

1.10.11.02

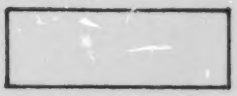
METHOD

Teacher demonstrates with two pieces of string, one twice as long as the other,and asks children to compare the lengths by eliciting the words twice as long or one half as long. Teacher can also use pairs of cuisenaire rods (white and red; yellow and orange) and other materials.

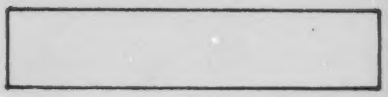
10

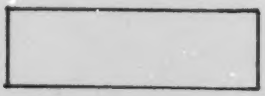
I.O. 1.10.11.02 NAME _____

PUT AN X ON THE ROD THAT IS TWICE AS LONG AS THIS ROD →

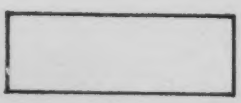
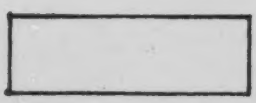
A. B.  C.

PUT AN X ON THE ROD THAT IS HALF AS LONG AS THIS ONE:

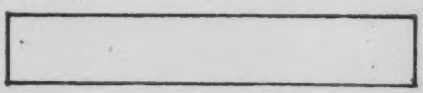


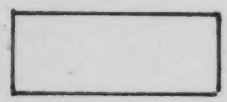
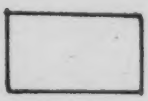
A. B. C. 

PUT AN X ON THE ROD THAT IS AS LONG AS THIS ONE:

A.  B.  C.

PUT AN X ON THE ROD THAT IS HALF AS LONG AS THIS ONE :



A. B.  C. 

2.10.11 LINEAR MEASUREMENT

INSTRUCTIONAL OBJECTIVES

PREREQUISITES	The student will be able to...
1.10.11	master all I.O.s in the module: compare two or more objects for equivalent and non-equivalent lengths;
	estimate the length and height of objects as to twice as long and half as long:
	identify the meter stick.
NEW I.O.s	The student will be able to...
2.10.11.01	recognize a meter and develop an understanding of objects that approximate the size of a meter (m).
2.10.11.02	recognize a centimeter and develop an understanding of objects that approximate the size of a centimeter (cm).
2.10.11.03	compare meter (m) and centimeter (cm), using non-standard terms. e.g., (bigger, smaller)

10

2.10.11.04 determine which objects should be measured in meters (m) and which objects should be measured in centimeters. (cm)

2.10.11.05 estimate and measure familiar objects to the nearest meter (m).

2.10.11.06 estimate and measure familiar objects (less than 1 meter) to the nearest centimeter (cm).

10

Note to teacher

Introduce abbreviations: m for meter
cm for centimeter

Make A Meter

Cut out the 5 parts and paste them end to end.

Now use your meter to measure.

Are you taller than 1 meter? Yes No

What can you find that is exactly 1 m long or 1 m high?

Name _____

EASY FIND OUT!

	Yes	No
1. Are you taller than a meter?	○	○
2. Are you shorter than a meter?	○	○
3. Does the meter stick come up to your chin?	○	○
4. Does the meter stick come up to your nose?	○	○
5. Can you stretch your arms as wide as a meter?	○	○
6. Can you step as far as a meter?	○	○

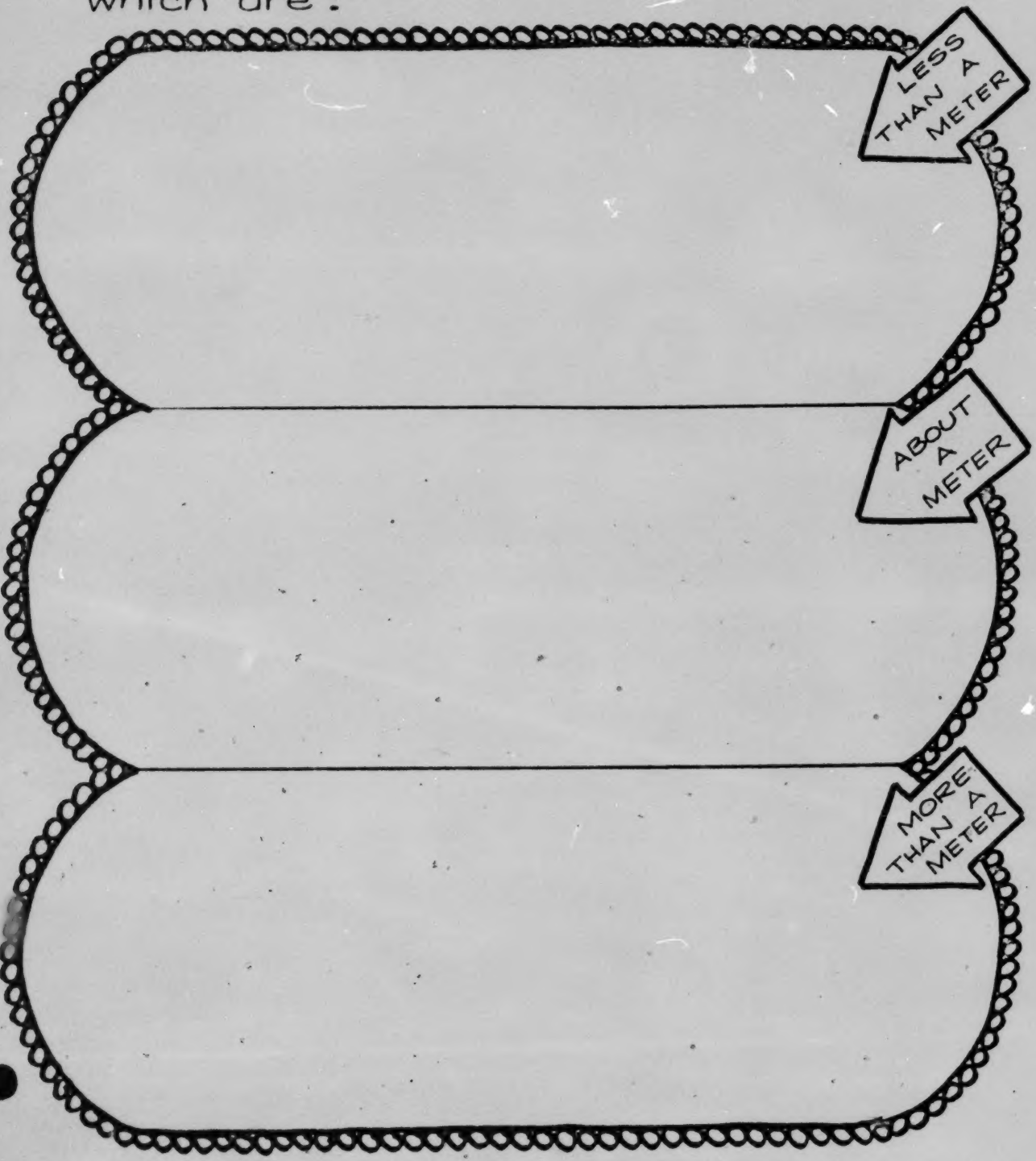
HARD FIND OUT!

1. Is a car longer than 2 meters?	○	○
2. Is your classroom longer than 6 meters?	○	○
3. Is your school taller than 15 meters?	○	○
4. Do you live farther than 100 meters from school?	○	○

 NAME _____

As LONG as a Meter

Draw pictures of things you can find which are:



I.O. 2.10.11.01 NAME _____

IS IT TALLER THAN ONE METER?

Color the correct answer box.

	YES	NO
1. Your desk?		
2. Your best friend?		
3. Your chair seat?		
4. The teacher?		
5. The back of your chair?		
6. The teacher's desk?		

IS IT SHORTER THAN 2 METERS?

	YES	NO
1. You?		
2. The door of your classroom?		
3. From the window sill to the floor?		
4. Your dog?		
5. Your father?		
6.* Wilt Chamberlain?		

*He's 216 cm tall.

ACTIVITY

2.10.11.02

METHOD

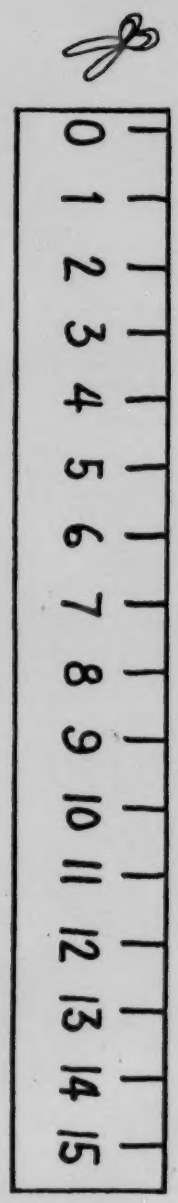
Teacher points out that the white cuisenaire rod is the length of one centimeter. She elicits from the children what objects are the size of 1 centimeter. (button, fingernail, beads, eraser or pencil, etc.) She also shows the children the length of 1 cm on the ruler.

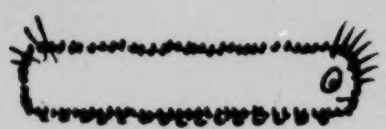
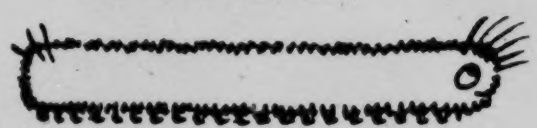
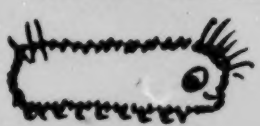
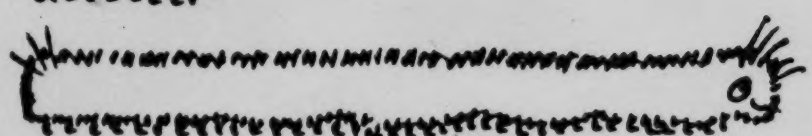
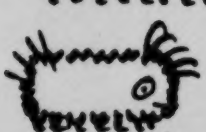
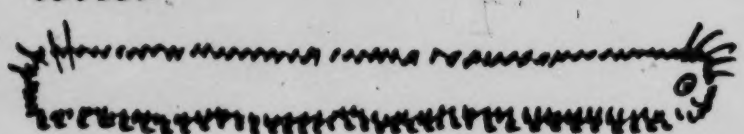
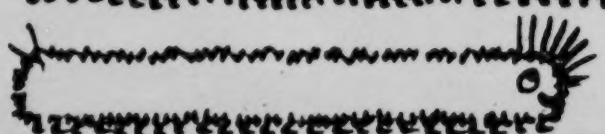
10

I.O. 2.10.11.02 NAME _____

Centimeter Centipedes

Cut out your centimeter ruler and measure the centipedes, like this:

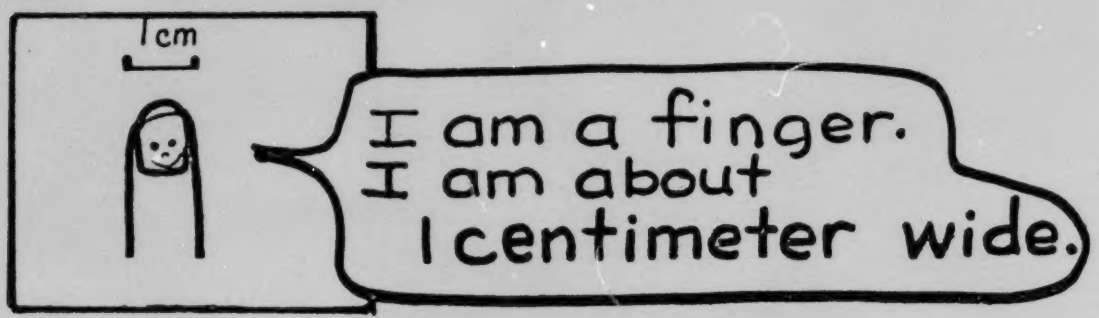


1. ___ cm
2.  ___ cm
3.  ___ cm
4.  ___ cm
5.  ___ cm
6.  ___ cm
7.  ___ cm
8.  ___ cm

Centipedes have 100 legs. Meters have 100 centimeters. A dollar has 100 cents.

Name _____

FINGER CENTIMETER



Now, draw around one of your own fingers which is about 1 cm wide. Give it a face!

CAN YOU FIND CENTIMETERS

FIND SOME THINGS THAT MEASURE ABOUT ONE CENTIMETER

DRAW THEM

ACTIVITY

2.10.11.04

METHOD

Teacher questions children about which objects they would measure in meters (possible responses- windows, cars, running distances). She will also ask which things might be measured in centimeters (pencil, desk).

10

Activity

2.10.11.04

How should these objects be measured ? Write the words in the correct column: pen, desk, bus, sailboat, truck, book, child, house, playground. Can you think of other objects to add to your list ?

Centimeters (cm)	Meters (m)

10

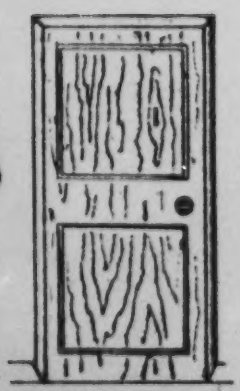
I.O. 2.10.11.05 NAME _____

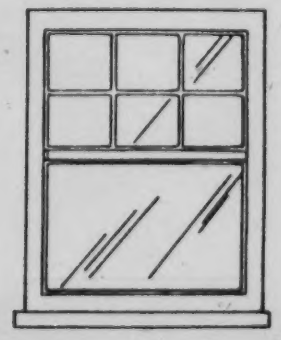
Estimating and Measuring Around Me

MATERIALS : METRIC TAPE, METER STICK, TRUNDLE WHEEL

ESTIMATE EACH OF THE FOLLOWING IN METERS. THEN MEASURE AND CALCULATE WHERE NECESSARY.

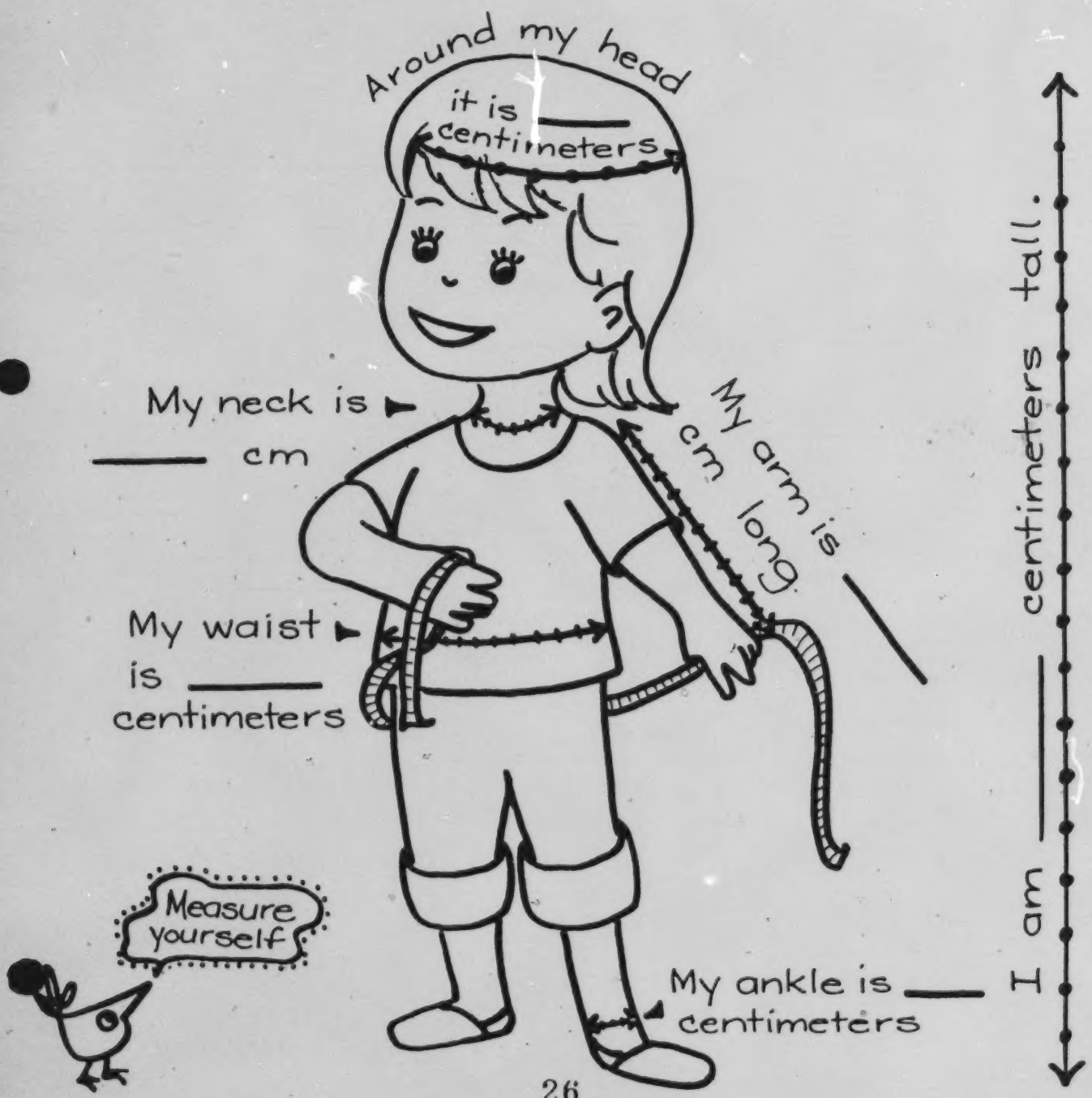
	Estimated Length	Measured Length
1. Width of your desk.	_____	_____
2. length of chalkboard eraser	_____	_____
3. Width of chalkboard	_____	_____
4. Width of the teachers desk.	_____	_____
5. Width of a door.	_____	_____
6. Height of a door.	_____	_____
7. Width of a window .	_____	_____
8. Length of this room.	_____	_____
9. Width of this room.	_____	_____
10. Height of a window.	_____	_____





METRIC ME

My name is _____

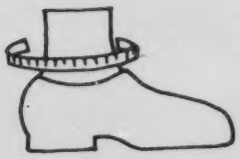

Around my head it is ___ centimeters
My neck is ___ cm
My arm is ___ cm long
My waist is ___ centimeters
Measure yourself
My ankle is ___ centimeters
I am ___ centimeters tall.

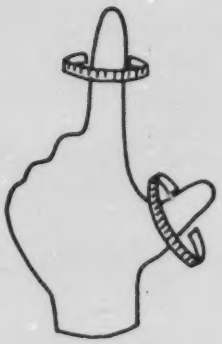
NAME _____

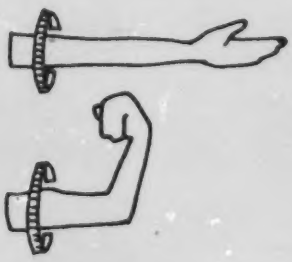
CENTIMETERS AROUND

Use your centimeter measurer and measure.
Compare with a friend.

	My Guess	My Measure
around my head	_____ cm	_____ cm
around my neck	_____ cm	_____ cm
around my ankle	_____ cm	_____ cm
around my knee	_____ cm	_____ cm
around my thumb	_____ cm	_____ cm
around my finger	_____ cm	_____ cm
around my waist	_____ cm	_____ cm
around my fist	_____ cm	_____ cm
around my chest (air out)	_____ cm	_____ cm
around my chest (air in)	_____ cm	_____ cm
around my muscle	_____ cm	_____ cm
around my big muscle	_____ cm	_____ cm







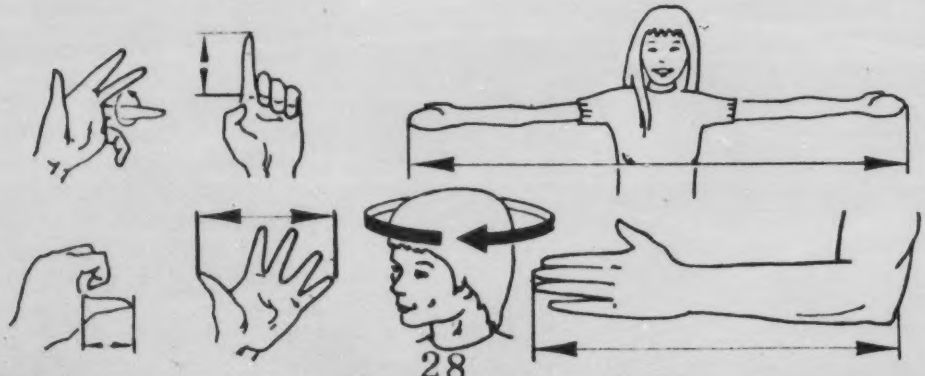
NAME _____

Estimating and Measuring Me

MATERIALS
centimetre ruler, metric tape, metre stick

Estimate the length in centimetres of each of the following and then measure the length.

	Estimated Length	Measured Length
1. length of your index finger	_____	_____
2. length of your thumb	_____	_____
3. length of your hand span	_____	_____
4. distance around your wrist	_____	_____
5. distance around your elbow	_____	_____
6. distance around your ring finger	_____	_____
7. distance from finger tip to elbow	_____	_____
8. length of your arm	_____	_____
9. length of your arm span	_____	_____
10. distance around your ankle	_____	_____
11. distance around your knee	_____	_____
12. height of your knee above the floor	_____	_____
13. distance around your neck	_____	_____
14. distance around your head	_____	_____
15. distance around your waist	_____	_____



3.10.11 LINEAR MEASUREMENT

INSTRUCTIONAL OBJECTIVES

PREREQUISITES	**The student will be able to...**
2.10.11	master all I.O.s in the module: estimate and measure objects to the nearest meter and centimeter.
NEW I.O.'s	**The student will be able to ...**
3.10.11.01	identify that there are 100 cm in a meter and one meter is equal to 100 cm.
3.10.11.02	estimate and measure objects, greater than a meter, in centimeters.
3.10.11.03	recognize a millimeter (mm) and develop an understanding of objects that approximate the size of a millimeter (mm).
3.10.11.04	identify objects measured in millimeters.

NOTE TO TEACHER:

introduce abbreviation : mm for millimeter.

10

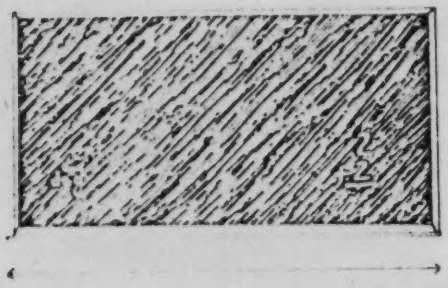
NAME _____

THE METER IS EQUAL TO 100 CENTIMETERS

FIND THESE OBJECTS IN YOUR ROOM.

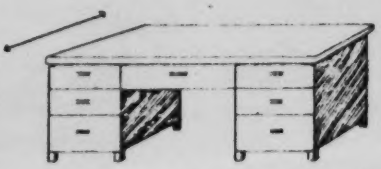
MEASURE IN THE DIRECTION OF THE ARROW.

MEASURE EACH OBJECT TO THE NEAREST METER.
THEN MEASURE EACH OBJECT TO THE NEAREST CENTIMETER.



1. _____ meters

_____ CENTIMETERS

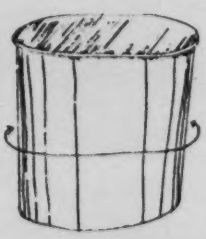


2. _____ meters

_____ CENTIMETERS

3. _____ meters

_____ CENTIMETERS



4. _____ meters

_____ CENTIMETERS

ACTIVITY

3.10.11.02

METHOD

Estimate and measure in centimeters.

OBJECT	ESTIMATE	MEASUREMENT
Height of a door		
Teacher's height		
Length of window sill		
Height of blackboard		
Length of chalkboard		

10

NAME _____

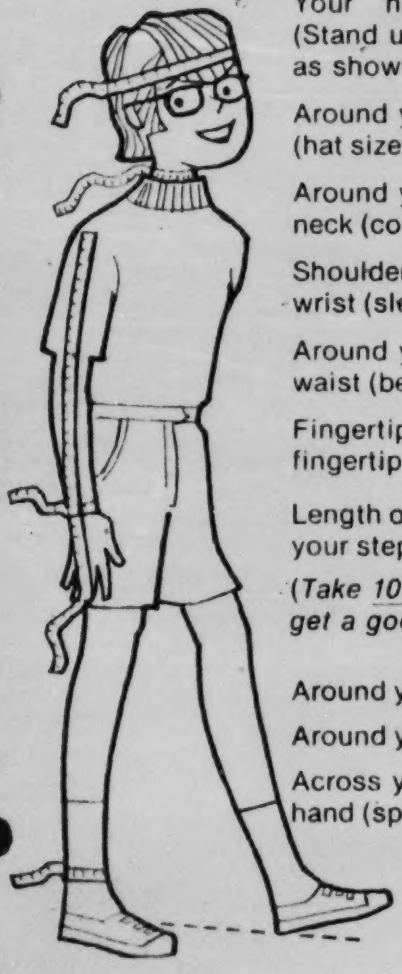
PERSONAL RECORD —How big?

Work with a friend to help you measure and fill out the chart. (It's hard to measure your own height!) Save the record, to see how much you grow in a year.

Name: _____

First date measured: _____ | Next Date: _____

Age: _____ years + _____ months | Age: _____



Measure		
Your height (Stand up straight against a wall as shown in the picture at top)	_____ cm (= _____ m)	_____
Around your head (hat size)	_____ cm	_____
Around your neck (collar size)	_____ cm	_____
Shoulder to wrist (sleeve length)		
Around your waist (belt size)	_____ cm	_____
Fingertip-to-fingertip (reach)	_____ cm	_____
Length of your step (*Take 10 steps to get a good measure*)	(10 paces = about _____ m = _____ cm) 1 pace = about _____ cm	_____ _____ _____
Around your wrist	_____ cm	_____
Around your ankle	_____ cm	_____
Across your stretched hand (span)	_____ cm	_____

I.O. 3.10.11.03-04 NAME _____

1. Get a dime . Look at its edge

   This is very close to a millimeter.

2. The millimeter is the unit used to measure things smaller than a centimeter.

   It is also used for things that do not measure an exact number of centimeters.

3. This is the short way of writing millimeter. mm

   Read 7 mm as 7 millimeters.

   Read these to your partner:

   1 mm 5 mm 8 mm 16 mm

   35 mm 50 mm 135 mm

   Write these the short way:

   2 millimeters 7 millimeters

   15 millimeters 81 millimeters

4. Use your metric ruler. Draw lines that are:

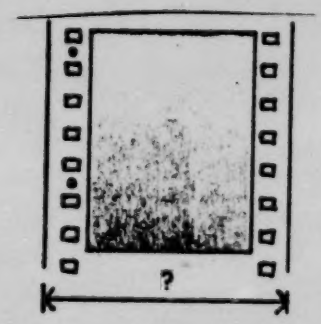
   50 mm 100 mm 132 mm

   Mark their lengths.

   Show the lines to your partner.

5. Ask your teacher for a small piece of movie film.

   Maybe you can get a piece of home movie film or a color slide.



MEASURE THE SIZE OF THE FILM.

NAME _____

6.

Try to look at the real things in these pictures.

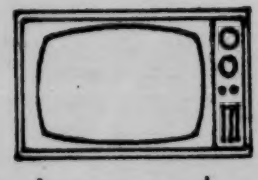
Pick which is the right measure of each thing.

door knob (height)

stamp

half dollar

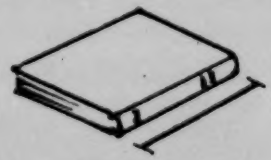
bread



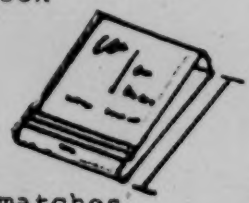
T.V. screen

basketball court

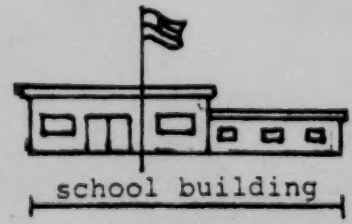
camera



school book (length)



book of matches



school building

20 mm	30 cm	48 mm
24 cm	90 m	40 cm
100 cm	3 cm	13 cm
28 m	5 mm	8 m

Write the measure next to the thing on a piece of paper.

7.

Make a list of different things that are measured best by each of these units.

meter	centimeter	millimeter

Try to list more things than anyone in your group.

M-4e-

I.O. 3.10.11.03-04

4.10.11 LINEAR MEASUREMENT

INSTRUCTIONAL OBJECTIVES

PREREQUISITES	The student will be able to...
3.10.11	master all I.O.'s in the module:
	identify that one meter is equal to 100 cm and measure objects greater than a meter in centimeters.
	recognize objects that approximate the size of a millimeter.
NEW I.O's	The student will be able to ...
4.10.11.01	identify that there are ten decimeters (dm) in one meter.
4.10.11.02	identify that there are 10 cm in one decimeter (dm).
4.10.11.03	identify that there are 10 mm in 1 cm.
4.10.11.04	identify that there are 100 mm in on dm.

10

4.10.11 LINEAR MEASUREMENT

NEW I.O.'s

4.10.11.05 identify that there are 1000 mm in 1 m.

4.10.11.06 identify that there are 1000 m in one kilometer (km).

4.10.11.07 estimate to the nearest meter and measure in meters and centimeters.

4.10.11.08 add and subtract like linear measures without regrouping.

e.g.,
```
  6 cm
  6 cm
  2 cm
+ 2 cm
 16 cm
```

10

4.10.11.09 measure and compute the perimeter of plane figures in like metric measures; no regrouping.

(Note - We have defined perimeter in e.09.01.05)

4.10.11.10 solve story problems related to above I.o.'s.

I.O. 4.10.11.01 NAME _____

Making a Metric Tape Measure

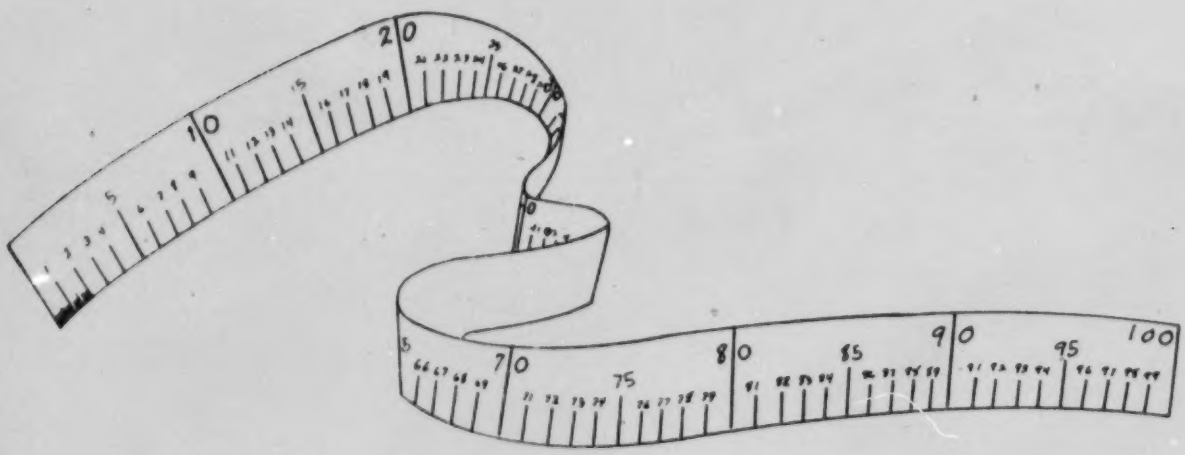
MATERIALS

METER STICK, ADDING MACHINE TAPE
AT LEAST ONE METER LONG, SHARP
COLORED PENCILS OR BALLPOINT PEN.

1. Follow these steps to make a metric tape measure.

   A. Cut a piece of tape exactly one meter long.

   B. Mark each of the 10 decimeter divisions from 10 to 100 with one color.



2. Using your metric tape, measure a distance of 5 meters.

   A. How many decimeters did you measure ? _____

   B. Measure a distance of 3 meters, How many decimeters did you measure ? _____

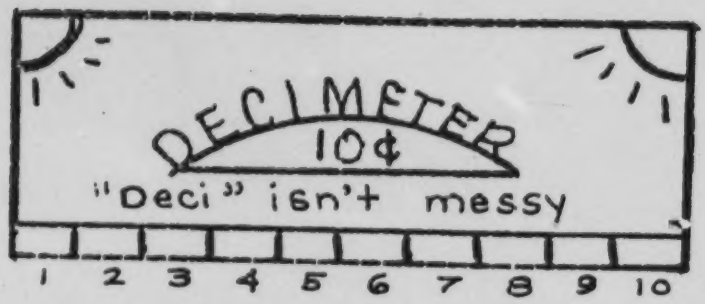
3. Using your metric tape, measure a distance of 20 decimeters.

   A. How many meters did you measure ? _____

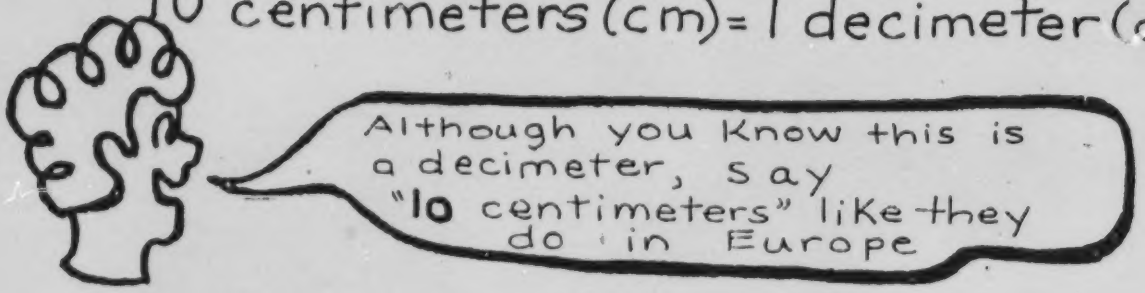
   B. Measure a distance of 40 decimeters, How many meters did you measure ? _____

 NAME _____

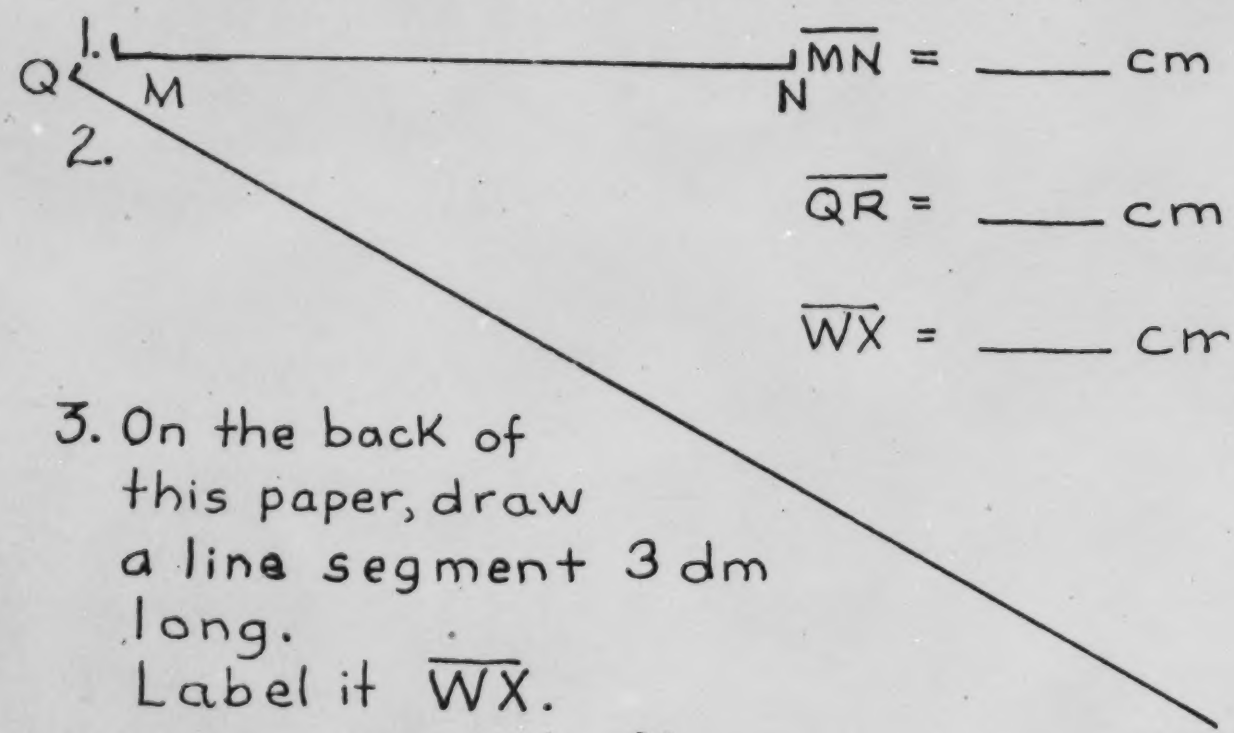
THE 10¢ DECIMETER BAR



10 centimeters (cm) = 1 decimeter (dm)



Measure the line segments



$\overline{MN}$ = _____ cm

$\overline{QR}$ = _____ cm

$\overline{WX}$ = _____ cm

3. On the back of this paper, draw a line segment 3 dm long. Label it $\overline{WX}$.

I.O. 4.10.11.02 NAME _____

DECIMETER DASH

In 5 minutes, list things about as long as a decimeter...

1. a new piece of chalk.
2.
3.
4.
5.
6.

(continue on back) SCORE ☐

...and a bout as long as 5 decimeters.

1. $\frac{1}{2}$ of a meter
2.
3.
4.
5.
6.

(continue on back) SCORE ☐

 NAME _____

MILLIMETER MANEUVERS

Each centimeter is divided into 10 equal parts. These very small parts are millimeters. The symbol for millimeter is

mm

Measure these line segments:

1. ____mm
2. ____mm
3. ____mm
4. ____mm
5. ____mm
6. Measure a crayon ____mm
7. A paper clip ____mm

*8. Draw a line 8 mm long

*9. Draw a line 16 mm long

* camera film sizes

 NAME _____

ONE METER

IS

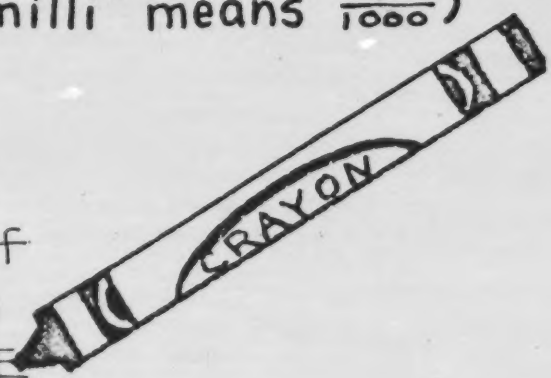
10 decimeters ("deci" means $\frac{1}{10}$)

or

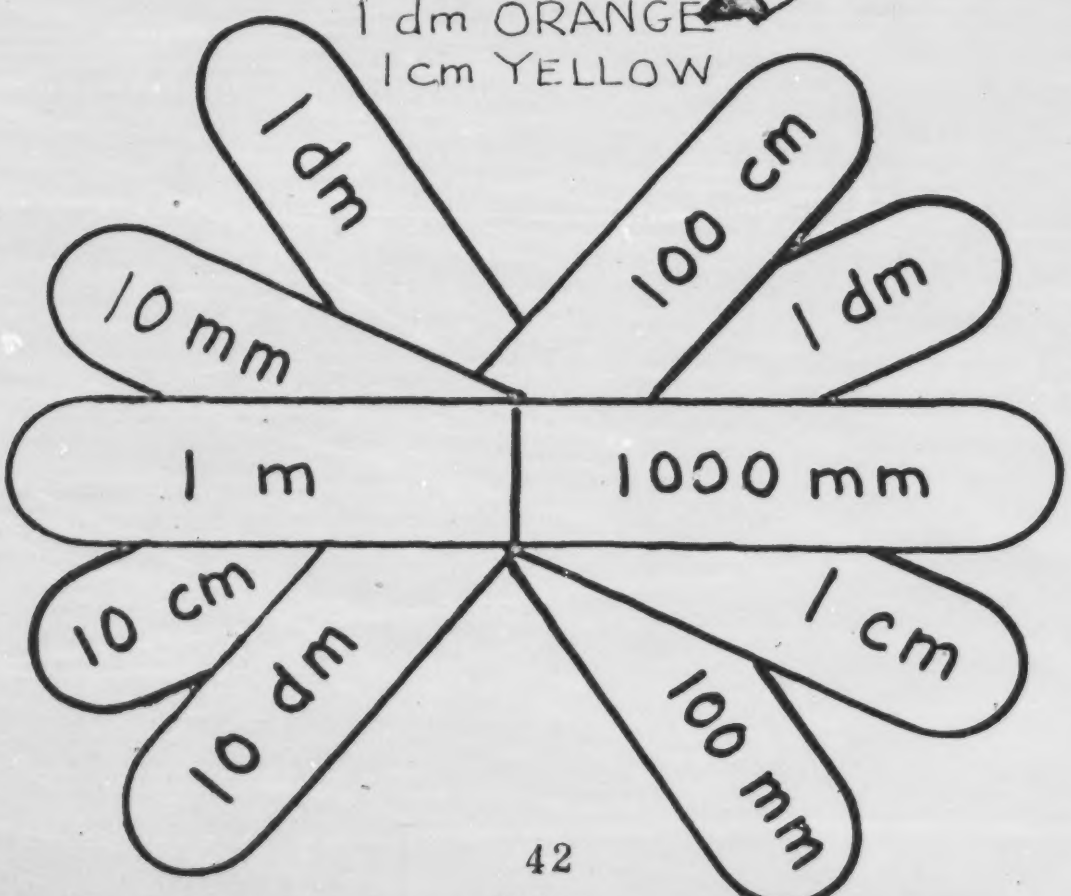
100 centimeters ("centi" means $\frac{1}{100}$)

or

1000 millimeters ("milli" means $\frac{1}{1000}$)



Color equivalents of
1 meter RED
1 dm ORANGE
1 cm YELLOW

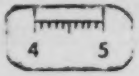


1.

Look at the metric ruler.

Look at the length between 4 and 5 cm.

Look at the small marks between 4 and 5.



Begin at 4 and count the number of small lengths up to 5.

How many of these " are there ?

Did you count 10 ? If not, count again.

2.

Get the meter stick.

Begin at 0 (zero) and go all the way to 100.

Count all of the small lengths on the meter stick.

How many " are there on the meter stick ?

3.

Did you count 1000 ? You should have.

Each of these small lengths is called a

millimeter

Say millimeter to your teacher.

4.

Millimeter is made of 2 parts:

milli and meter

milli means one thousandth ($\frac{1}{1000}$ or 0.001).

So millimeter is one thousandth part of a meter.

How many millimeters do you need to make 1 meter ?

1000 millimeters = 1 meter

NAME _____

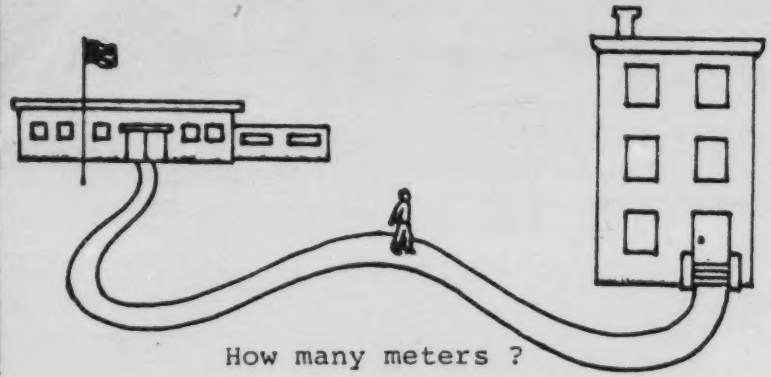
NAME

I.O. 4.10.11.06

(1.)

Next time you go home from school estimate how far it is in meters.

You may use your body measure (maybe your "pace"?) to help.



How many meters ?

Did you get a big number ?

Was it 1000 or more ?

For long distances the unit is

kilometer.

(say "kill-oh-meter").

It is 1000 meters.

1000 meters = 1 kilometer

"kilo" means thousand so

kilometer = 1000 meters

(2.)

Mark a length of 10 meters on the ground.

(maybe in the hallway, lunchroom or playground)

Get your partner to time you. Walk this length in 10 seconds.

Do this until you can walk that speed.

(3.)

If you walk this speed for 17 minutes without stop, you will have walked 1 kilometer.

Try it.

Now try to estimate how far school is from home.

M-6g-

I.O. 4.10.11.07 NAME _____

MEASURE UP IN METRICS

Measure small things in centimeters and large things in meters. Write the measurement on either side.

Meters		Centimeters
_____	1. Your shoe length	_____
_____	2. Your height	_____
_____	3. Your pencil length	_____
_____	4. Your friend's height	_____
_____	5. Width of your math book	_____
_____	6. Your father's height	_____
_____	7. Around your wrist	_____
_____	8. The length of a room	_____
_____	9. An inch on a ruler	_____
_____	10. The width of a room	_____
_____	11. A foot ruler	_____
_____	12. Something big _____	_____
_____	Turn paper upside down	_____
_____	Your answers for no. 2, 4, 6, 8, 10, 12 should be on the meter side.	_____

 NAME _____

METRIC ME

Measure the distance from various parts
of your body to your navel,
or nose,
or right ear.

navel to nose = _____ cm
navel to toes = _____ cm
navel to knee = _____ cm
navel to ankle = _____ cm
navel to _____ = _____ cm
navel to _____ = _____ cm
navel to _____ = _____ cm
navel to _____ = _____ cm
navel to _____ = _____ cm
navel to _____ = _____ cm

Take your ten longest measurements and add them up. Then construct a string to show the total length.

How does your string compare with others?

Attach all the strings in the class together.

How many meters long is the string?

ACTIVITY

4.10.11.08

METHOD

Add these centimeters:

A.	4 cm.	5 cm.	5 cm.	3 cm.	3 cm.	4 cm.
	+3 cm.	+3 cm.	+4 cm.	+3 cm.	+4 cm.	+5 cm.
	cm.	cm.	cm.	cm.	cm.	cm.

Subtract these centimeters:

B.	8 cm.	8 cm.	8 cm.	8 cm.	8 cm.	9 cm.
	-3 cm.	-5 cm.	-4 cm.	-6 cm.	-2 cm.	-3 cm.
	cm.	cm.	cm.	cm.	cm.	cm.
C.	7 cm.	9 cm.	10 cm.	10 cm.	10 cm.	10 cm.
	-3 cm.	-5 cm.	-5 cm.	-7 cm.	-2 cm.	-3 cm.
	cm.	cm.	cm.	cm.	cm.	cm.

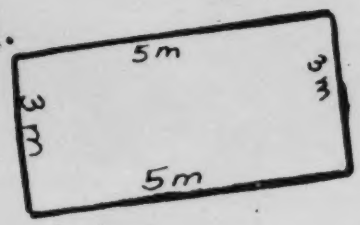
Find the answers.

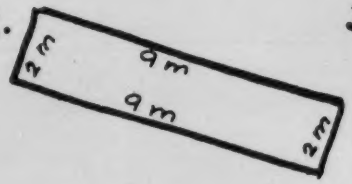
D.	130 mm.	110 mm.	130 mm.	120 mm.	130 mm.
	-50 mm.	-70 mm.	-40 mm.	-50 mm.	-70 mm.
	mm.	mm.	mm.	mm.	mm.
E.	128 mm.	133 mm.	117 mm.	122 mm.	105 mm.
	-86 mm.	-62 mm.	-92 mm.	-31 mm.	-72 mm.
	mm.	mm.	mm.	mm.	mm.

10

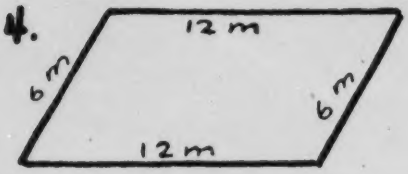
I.O. 4.10.11.09 NAME _____

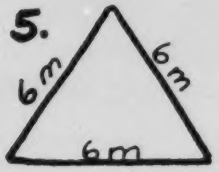
CAN YOU MEASURE PERIMETERS IN METERS?

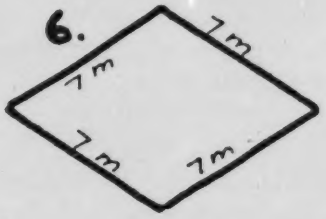
1. 

2. 

3.

4. 

5. 

6. 

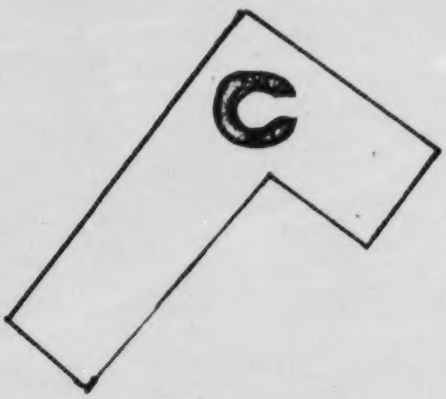
1. _____ meters
2. _____ m
3. _____ m
4. _____ m
5. _____ m
6. _____ m

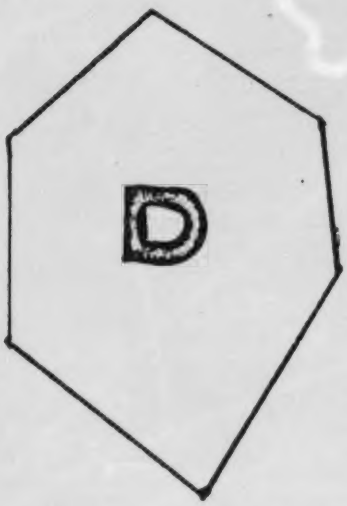
• If the perimeter of a parallelogram is 84 meters and 2 sides are each 12 m long, how long is each of the other sides ? _____

T.O. 4.10.11.09 NAME _____

PERIMETER PUZZLE

Measure the perimeter of each shape in cm and mm.





A ____ cm ____ mm

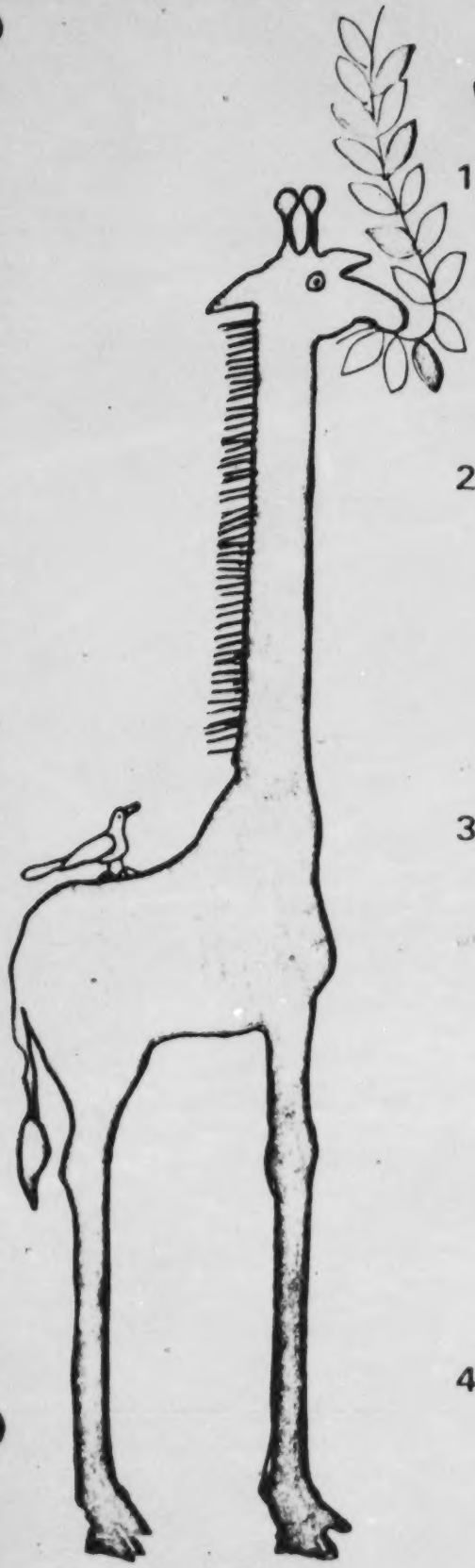
C ____ cm ____ mm

B ____ cm ____ mm

D ____ cm ____ mm

On the back of this paper, draw a shape with a perimeter of 50 centimeters.

NAME _____



JOEY GIRAFFE

1. Joey Giraffe was taking a hike. He ran 13 kilometers, jogged 28 kilometers, and walked 17 kilometers. How many kilometers did Joey travel?

   _____ km

2. After traveling the distance in Exercise 1, Joey wanted some water to drink. If the water is 130 kilometers from where he started, how much farther does Joey have to go?

   _____ km

3. After traveling the distance in Exercise 1, and while Joey was thinking about getting some water, his cousin Jerry came along. Jerry decided to go to the waterhole too. If they walk at the rate of 8 kilometers per hour, how long will it take them to get there?

   _____ hours

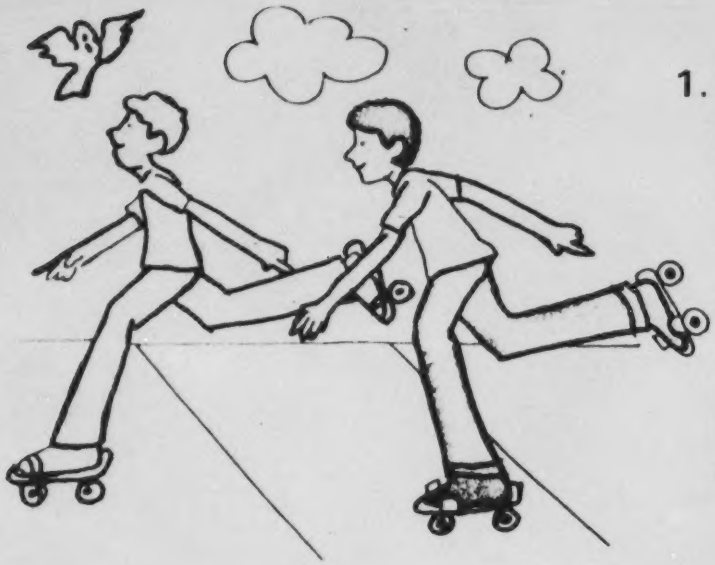
   (Don't worry, giraffes can go many hours without water.)

4. Joey is 480 centimeters tall. Do you think he could stand up straight in your classroom?

   _____

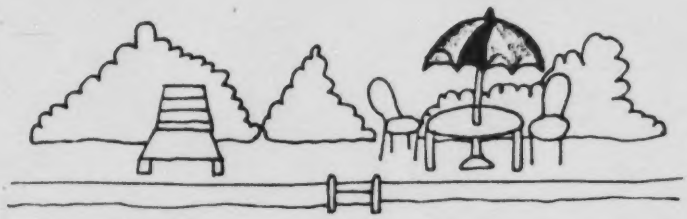
I.O. 4.10.11.10 NAME _____

PETE AND KEN

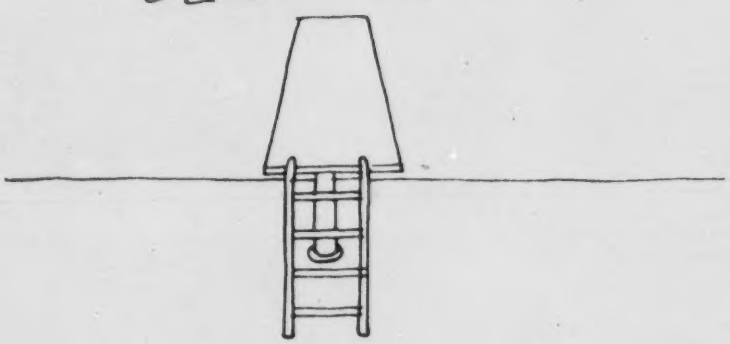


1. Pete and Ken like to go roller-skating. Pete can skate 8 m before he falls. Ken can skate 17 m before he falls. Who can skate the greater distance before falling? _____
   How much greater?
   _____ m

2. In the summer the boys like to swim. The pool is 20 m wide. Pete can swim across the pool and back again before he needs to rest. How far can he swim without resting?
   _____ m



3. Ken can swim 15 m without resting. Which boy can swim farther before resting? _____
   How much farther?
   _____ m



5.10.09 METRIC PREFIXES

INSTRUCTIONAL OBJECTIVES

PREREQUISITES	The student will be able to...
4.10.11	recognize the equivalency of standard units of metric measures.
5.07.04	write any mixed number or proper fraction with a denominator of 1000 as a mixed decimal. Write any decimal in the thousandths as a proper fraction or mixed number.

NEW I.O.s	The student will be able to...
5.10.09.01	identify meter, liter and gram as the units place (root words).
5.10.09.02	identify deci as tenth; centi as hundredth and milli as thousandths of the standard unit. e.g., centimeter - one hundredth of a meter.

10

5.10.09.03 identify deka as ten times, hecto as hundred times; and kilo as one thousand times the standard unit.

e.g., kilogram = one thousand grams.

10

I.O. 5.10.09.01.02.03

PREFIXES AND PLACE VALUE

The meter (m) is the basic unit of linear measure. We use the prefixes *kilo*, *hecto*, *deka*, *deci*, *centi*, and *milli* to name units longer or shorter than a meter. The prefixes name place value.

Place Value	thousands	hundreds	tens	ones	tenths	hundredths	thousandths
Meaning	1000	100	10	1	0.1	0.01	0.001
Prefix	kilo	hecto	deka	BASIC UNIT	deci	centi	milli

OBJECTIVES

To learn four common SI units, their symbols, and what they measure

To learn six of the SI prefixes, their symbols, and values

Unit	Symbol	Quantity Measured
second	s	time
metre	m	length
litre	l or L	capacity
gram*	g	mass

*Technically, the kilogram is the base unit for measuring mass. It is the only base unit that contains a prefix. In this book the gram will be considered the base unit to avoid confusion because of the prefix.

Prefix	Symbol	Multiplying Factor
kilo	k	1000
hecto	h	100
deca	da	10
	Base Unit	1
deci	d	0.1
centi	c	0.01
milli	m	0.001

Note that the three prefixes smaller than the base unit end in the letter i.

5.10.10 METRIC-DECIMAL RELATIONSHIPS

INSTRUCTIONAL OBJECTIVES

PREREQUISITES	The student will be able to...
5.07.04	master all I.O.'s in the module: write any mixed number or proper fraction with a denominator of 1000 as a mixed decimal.
	write any decimal in the thousandths as a proper fraction or mixed number.
5.10.09	master all I.O.'s in the module: identify all root words and all prefixes of the metric system (from milli to kilo).
NEW I.O.s	The student will be able to...
5.10.10.01	identify any standard metric unit of measure (meter, liter, gram). e.g., 1.0 m, 1.0 g, 1.0 l

10

5.10.10.02 write any tenth of a standard metric unit in decimal notation.
(decimeter, decigram, deciliter).

e.g., $1\ dm = \frac{1}{10}\ m = 0.1m$

$1\ dg = \frac{1}{10}\ g = 0.1g$

$1\ dl = \frac{1}{10}\ l = 0.1\ l$

5.10.10.03 write any hundredth of a standard metric unit in decimal notation (centimeter, centigram, centiliter)

e.g., $1\ cm = \frac{1}{100} m = 0.01m$

$1\ cg = \frac{1}{100} g = 0.01g$

$1\ cl = \frac{1}{100}\ l = 0.01\ l$

5.10.10.04 write any thousandth of a standard metric unit in decimal quotion;
(millimeter, milligram, milliliter).

e.g., $1\ mm = \frac{1}{1000\ m} = 0.001\ m$

$1\ mg = \frac{1}{1000\ g} = 0.001\ g$

$1\ ml = \frac{1}{1000\ l} = 0.001\ l$

10

1. In the metric system, certain prefixes always mean the same thing. There are 3 prefixes that are used to show measurements that are larger than a meter. The prefix *deka* means 10 times.

Put a *deka* before *meter*, and you know that a dekameter is _____times as big as a meter.

2. The prefix *hecto* means 100.

There are_____meters in a hectometer.

3. A *kilo*meter is 1000 meters.

kilo means _____ .

4. Fill in this table.

Prefix	Means
kilo	
hecto	
deka	

5. A kilometer is _____meters.

6. The prefix deka means _____ .

7. There are also 3 prefixes that show measurements smaller than a meter.

deci means 1/10 (or 0.1)

A decimeter is _____ of a meter(s)

8. *centi* means 1/100.

A centimeter is _____ of a meter(s)

M-10a-

I.C. 5.10.10.01-02.03.04

9.

The prefix *milli* means 1/1000.

A millimeter is _____of a meter(s)

1.

A millimeter is _____meter(s)

All of the prefixes meaning less than a meter end in the letter ___ .

12.

Fill in the table.

Prefix	Means
deci	
centi	
milli	

61

13.

Which prefixes are used to show measurements that are larger than a meter?

A. deci
B. kilo
C. milli
D. deka

14.

Which prefixes are used to show measurements that are smaller than a meter?

A. centi
B. hecto
C. milli
D. deci

15.

1000 meters = _____ meter(s)

1/1000 meter = _____ meter(s)

16.

A meter is the basic length measurement. Look at the prefix to compare another measurement to a meter.

A centimeter is _____ meter(s)

62

M-10b-

I.O. 5.10.10.01-02.03-04

17.

Circle the right choice in the ( )'s.

A hectometer is $\left(\frac{1}{100}\right)$ (100) meter(s)

18.

A dekameter is _____ meters.

21.

1 millimeter = _____ meter(s)

1 kilometer = _____ meter (s)

22.

Circle the right choice.

A decimeter is $\left(\frac{1}{10}\right)$ (10) meters.

19.

Fill in the blanks.

1 decimeter = _____ meter(s)

1 dekameter = _____ meter(s)

23.

Fill in the blanks for this question

1/100 meter = _____ meter(s)

10 meters = _____ meter(s)

1 centimeter = _____ meter(s)

1 hectometer = _____ meter(s)

24.

Fill in the prefixes in this table.

Prefix	Means
	1000
	100
	10
	.1
	.01
	.001

M-10c-

PREFIXES AND PLACE VALUE

The meter (m) is the basic unit of linear measure. We use the prefixes *kilo*, *hecto*, *deka*, *deci*, *centi*, and *milli* to name units longer or shorter than a meter. The prefixes name place value.

Place Value	thousands	hundreds	tens	ones	tenths	hundredths	thousandths
Meaning	1000	100	10	1	0.1	0.01	0.001
Prefix	kilo	hecto	deka	BASIC UNIT	deci	centi	milli

Write the correct prefix.

thousandths place (0.001) _____

hundredths place (0.01) _____

tenths place (0.1) _____

tens place (10) _____

hundreds place (100) _____

thousands place (1000) _____

Each metric unit is 10 times the next *smaller* unit and 0.1 of the next *larger* unit.

Name the unit.

10 times a meter _____

0.1 meter _____

100 times a meter _____

0.01 meter _____

0.1 centimeter _____

kilo	hecto	deka	METER	deci	centi	milli

One place to the right of any place is 0.1 $\left(\frac{1}{10}\right)$ of that place.

0.1 of a meter is a decimeter. **0.1 m = 1 dm**

0.1 of a decimeter is a _____.

0.1 of a kilometer is a _____.

0.1 of a centimeter is a _____.

kilo	hecto	deka	METER	deci	centi	milli

Two places to the right of any place is 0.01 $\left(\frac{1}{100}\right)$ of that place.

0.01 of a meter is a centimeter. **0.01 m = 1 cm**

0.01 of a decimeter is a _____.

0.01 of a hectometer is a _____.

kilo	hecto	deka	METER	deci	centi	milli

Three places to the right of any place is 0.001 $\left(\frac{1}{1000}\right)$ of that place.

0.001 of a meter is a millimeter. **0.001 m = 1 mm**

0.001 of a dekameter is a _____.

0.001 of a kilometer is a _____.

5.10.11 LINEAR MEASUREMENT

INSTRUCTIONAL OBJECTIVES

PREREQUISITES	The student will be able to...
4.10.11	master all I.O.'s in the module:
	identify 10 dm = 1 m 10 cm = 1 dm 10 mm = 1 cm 100 mm = 1 dm 1000 mm = 1 m 1000 m = 1 km
	compute the perimeter of plane figures in metric measures.
5.10.09	identify the root words and prefixes for metric measures;
5.10.10	write any standard metric unit in equivalent fraction and decimal notation. e.g., 1 cm = $\frac{1}{100}$ = 0.01 m

10

5.10.11 LINEAR MEASUREMENT

NEW I.O.s — The student will be able to...

5.10.11.01 add and subtract linear measures without regrouping;
(Do not skip columns)
e.g.,

Correct			Incorrect		
5 m	7 dm	3 cm	5 m	3 cm	4 mm
-2 m	5 dm	1 cm	-2 m	1 cm	2 mm
3 m	2 dm	2 cm	3 m	2 cm	2 mm
				decimeter column was omitted	

5.10.11.02 add and subtract linear measures with regrouping;
(Do not skip columns. See above example)

10

5.10.11.03 (a) define area as the measurement of a region inside a closed curve;
(b) measure the area of squares and rectangles using square units.

5.10.11.04 find the area of a rectangle using metric units of measure;

5.10.11.05 solve story problems related to the above I.O.s.

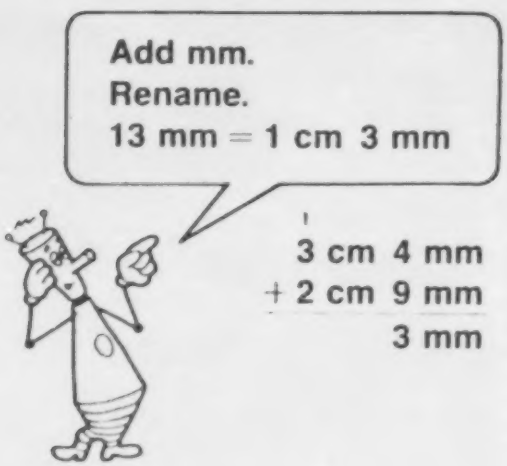
FIND THE MISSING NUMBER

Example: (+)	Example: (–)
17 hm + ____ hm = 34 hm	33 mm – 9 mm = ____ mm
17 hm + 17 hm = 34 hm	33 mm – 9 mm = 24 mm

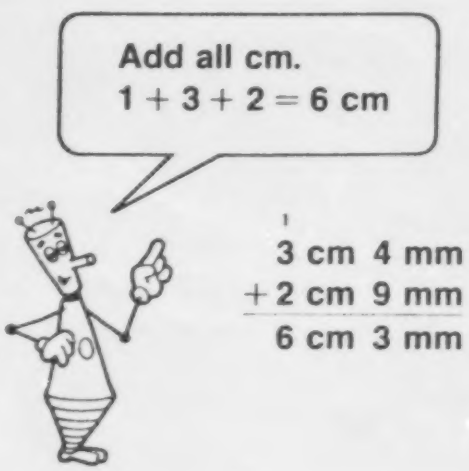
1. 13 m – ____ m = 7 m
2. 5 m + ____ m = 9 m
3. 14 dm – 9 dm = ____ dm
4. 11 dm + 8 dm = ____ dm
5. ____ cm – 6 cm = 15 cm
6. ____ cm + 8 cm = 19 cm
7. 16 mm – 11 mm = ____ mm
8. 40 mm – ____ mm = 17 mm
9. 45 dam – 4 dam = ____ dam
10. 72 dam + 18 dam = ____ dam
11. 82 hm + ____ hm = 104 hm
12. 71 hm – ____ hm = 34 hm
13. 19 km – 14 km = ____ km
14. 17 km + 49 km = ____ km
15. 100 km – ____ km = 37 km
16. 15 cm + 82 cm = ____ cm
17. 75 dm – 13 dm = ____ dm
18. ____ hm + 9 hm = 34 hm
19. 92 dam – 16 dam = ____ dam
20. 19 hm – ____ hm = 4 hm
21. 22 cm + ____ cm = 56 cm
22. 97 mm + 37 mm = ____ mm
23. 102 dm – 19 dm = ____ dm
24. ____ m – 14 m = 26 m
25. 46 cm + 18 cm = ____ cm
26. 98 km + ____ km = 100 km
27. 36 mm – 9 mm = ____ mm
28. 214 cm + 8 cm = ____ cm
29. 96 dm – 19 dm = ____ dm
30. ____ m – 18 m = 52 m

RENAMING IN ADDITION

10 mm = 1 cm
10 cm = 1 dm
100 cm = 1 m
1000 m = 1 km



3 cm 4 mm
+ 2 cm 9 mm
3 mm



3 cm 4 mm
+ 2 cm 9 mm
6 cm 3 mm

Add.

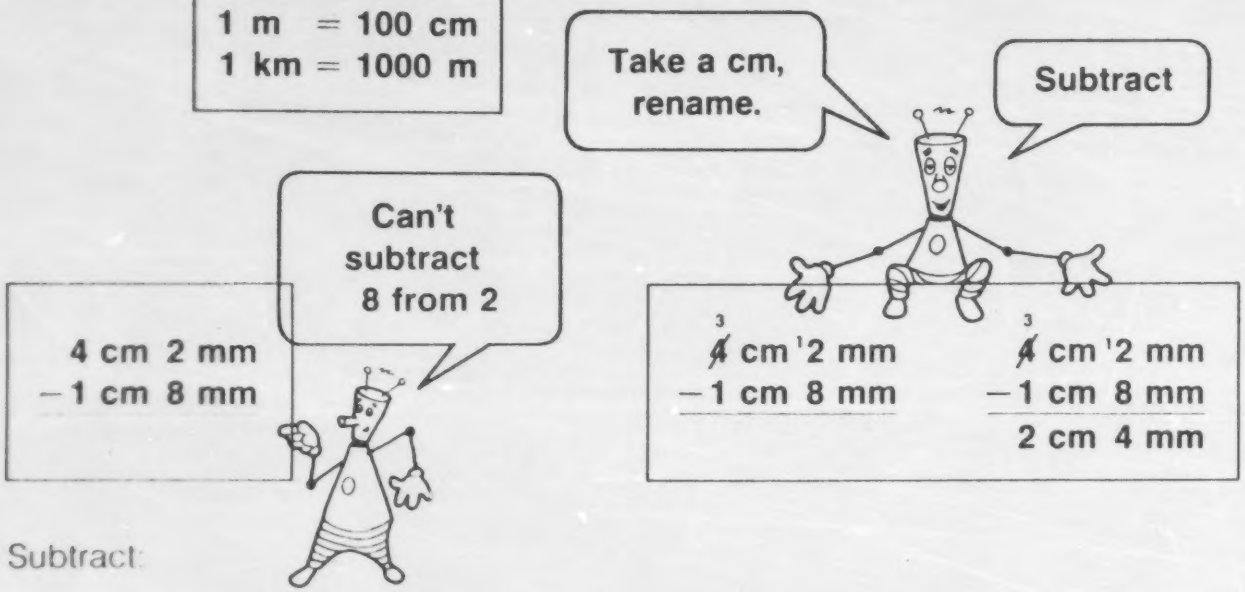
6 cm 7 mm + 2 cm 9 mm	4 dm 9 cm + 3 dm 6 cm	5 cm 5 mm + 1 cm 8 mm	3 m 54 dm + 4 m 63 dm
4 cm 8 mm 1 cm 5 mm + 2 cm 4 mm	2 dm 7 cm 5 dm 4 cm + 1 dm 6 cm		4 m 31 dm 3 m 25 dm + 1 m 80 dm
1 dam 375 m + 8 dam 900 m	3 km 550 hm + 5 km 621 hm		7 km 20 hm + 1 km 80 hm

BRAINTWISTER:

8 m 166 dm 34 cm
+ 2 m 532 dm 88 cm

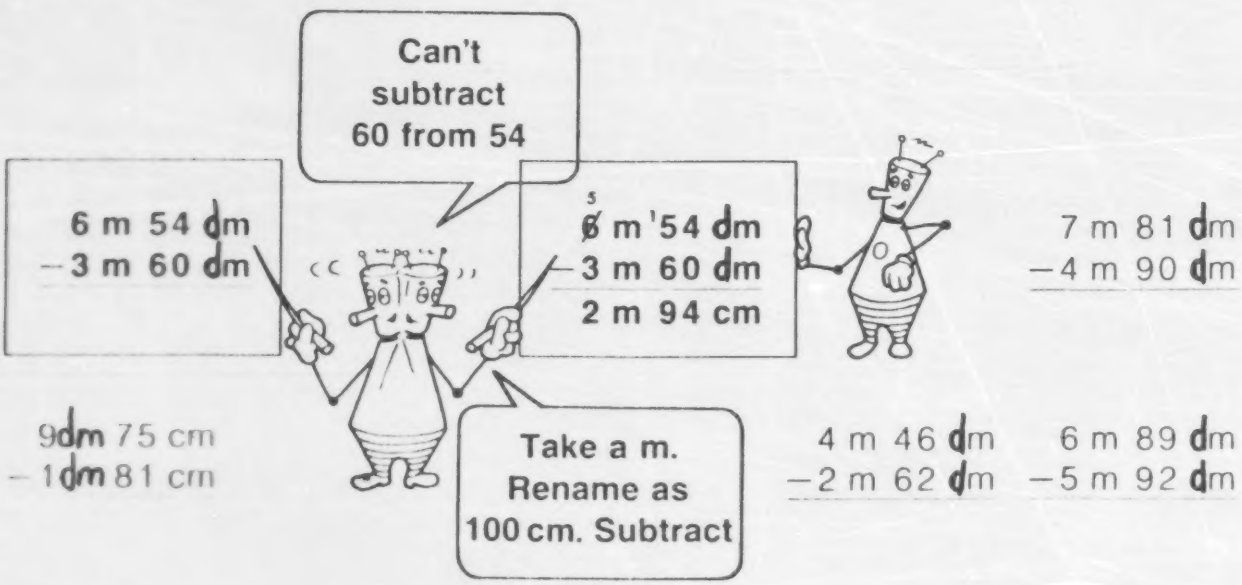
RENAMING IN SUBTRACTION

1 cm = 10 mm
1 dm = 10 cm
1 m = 100 cm
1 km = 1000 m



Subtract:

5 cm 8 mm −2 cm 9 mm	9 dm 6 cm −7 dm 8 cm	9 cm 4 mm −6 cm 7 mm



7 m 81 dm
−4 m 90 dm

9dm 75 cm
−1dm 81 cm

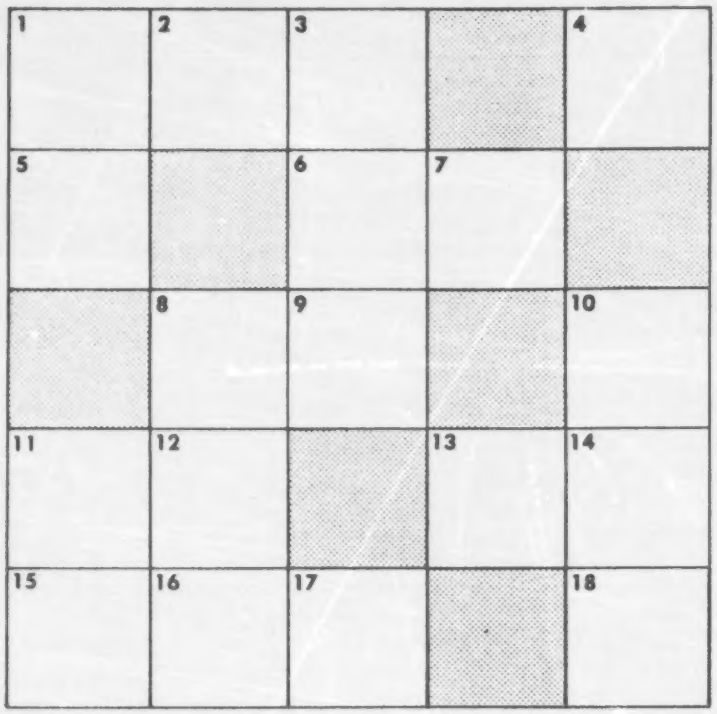
4 m 46 dm
−2 m 62 dm

6 m 89 dm
−5 m 92 dm

ARE YOU READY FOR THESE?

6 km 113 hm −2 km 600 hm	7dam 519 m −5dam 703 m	4 km 279hm −1 km 300 hm

CROSS-NUMERAL PUZZLE



Complete the diagram by finding the answers to the problems below. One digit per space.

Across

1. 41 cm + 93 cm = ____ cm
4. 70 dm − 66 dm = ____ dm
5. 28 m − 28 m = ____ m
6. ____ dm + 26 dm = 53 dm
8. 3 cm = ____ mm
10. 4 cm + 2 cm + 2 cm = ____ cm
11. ____ dm − 26 dm = 14 dm
13. 7 cm + 15 cm = ____ cm
15. 34 cm + 275 cm = ____ cm
18. 40 mm = ____ cm

Down

1. 1 dm = ____ cm
2. 153 cm − 150 cm = ____ cm
3. 16 m + 404 m = ____ m
4. 20 dm+6 dm−22 dm = ____ dm
7. 70 cm = ____ dm
8. 400 dm − 100 dm = ____ dm
10. 275 mm + 549 mm = ____ mm
11. ____ cm + 25 cm = 68 cm
13. 20 mm = ____ cm
17. 1 cm − 1 mm = ____ mm

FINDING AREA

1 cm^2

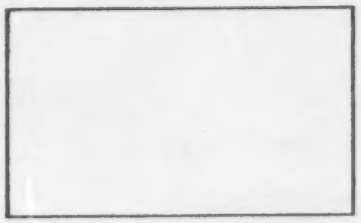
Cut out the region at the left. Its area is one square centimeter. Guess in square centimeters the area of each region below. Then use the square that you cut out to measure the area of each.

1.

guess _____ cm^2

measurement: _____ cm^2

2.



guess: _____ cm^2

measurement: _____ cm^2

3

guess: _____ cm^2

measurement: _____ cm^2

4.

guess: _____ cm^2

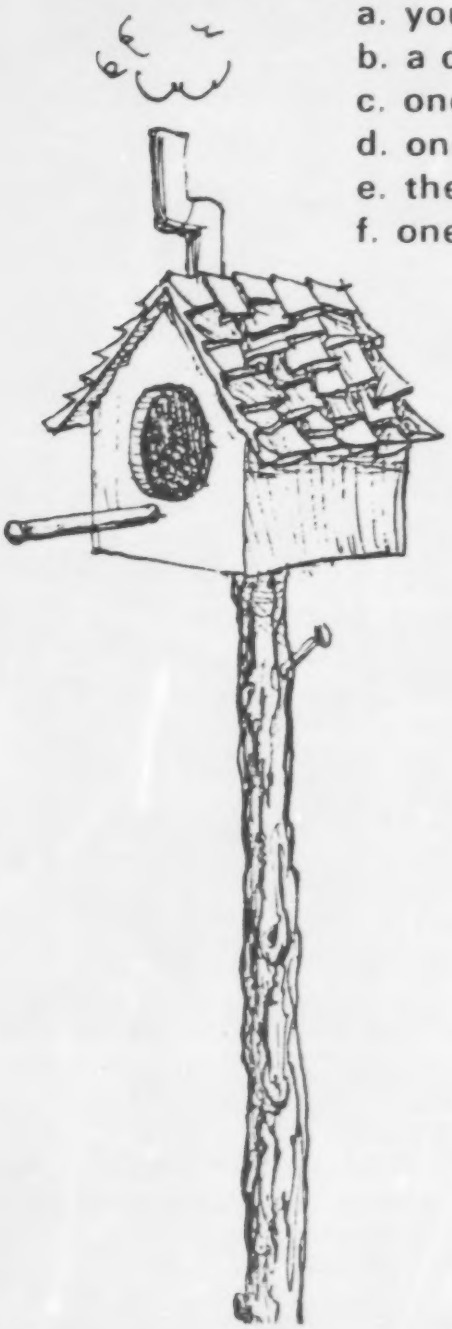
measurement: _____ cm^2

I.O. 5.10.11.04

Finding Amount of Surface

1. Draw and cut a square 20 cm by 20 cm.

2. Use your square to calculate the amount of surface that is represented by



   a. your desk top
   b. a door in the classroom
   c. one section of the chalk board
   d. one section of a window
   e. the teacher's desk top
   f. one other object (your choice)

3. Estimate the number of squares that will cover each surface.

4. Count the number of squares that will cover each surface.

5. Record your results on a chart.

ACTIVITY

5.10.11.05

1. How many 15 centimeter boards could be cut from one board 2 meters long? _____boards

2. How far can Wayne walk in thirty minutes if he walks 6 km in an hour? _____km

3. What is the perimeter of a triangle whose sides are 3 cm, 4 cm and 5 cm?

4. What is the perimeter (in centimeters) of a rectangle whose length is 46 mm and width is 29 mm? _____cm

5. The diameter of a quarter is 24 mm and that of a dime, 18 mm. What is the difference in their diameters? ____mm

6. James needed tape for some projects. He used 2 m on Monday, 4 m on Tuesday, 3 m on Wednesday and 1 m on Thursday. How much tape did James use?

7. Bobby was 47 cm long when he was born. His brother Jerry was 53 cm long when he was born. How much longer was Jerry? ____cm

10

8. On a 390 meter hole, Carol hit the golf ball three times directly toward the hole, dist ances of 125 meters, 115 meters, and 135 meters. How far from the hole did that leave the ball? _____m

9. Find the area in square centimeters of a table top 125 cm by 80 cm. _____m^2

I.O. 5.10.11.05

1. What is the perimeter of a certain softball diamond that is 18 meters between bases ? _____ m

2. Find the area of Mary's garden which is 32 meters long and 9 meters wide. _____ m^2

3. Jennie needed some material to make a dress. She bought 2 meters of material which was on sale for $ 3.49 a meter. How much did she spend ? $_____

4. Gary was center on his high school basketball team. If Gary is 195 centimeters tall, what is his height in meters.

5. If Dean jogs 3 kilometers a day, 5 days a week, 50 weeks a year, how many kilometers does Dean jog in a year ?

6. Chris mowed a lawn 24 meters by 15 meters. What area did Chris mow ? _____ m^2

7. How much would it cost to fence in a rectangular yard 33 meters by 22 meters if fencing cost 30¢ per meter ?

$_____

8. The Washington Monument is about 168 meters high. The Empire State Building is about 446 meters high. What is the difference in their heights ? _____ m

9. What is the area in square centimeters of a counter top whose length is 125 cm and width is 120 cm ? _____ m^2

10. Find the perimeter of a square chessboard 32 centimeters on each side. _____ cm

11. The perimeter of a square table is 340 centimeters. What is the length of each side? _____ cm

12. On a trip to Mexico a man drove 403 km, 376 km, and 384 km on 3 successive days. What was the total distance traveled?

_____ km

13. The largest fish ever caught on a rod measured about 513 cm long. How many millimeters is that ? _____mm

14. There are 3000 meters in 3 km. How many meters in 1 km?

_____m

15. The smallest shark found in the Philippines measures only 15 cm. How many millimeters is that ? _____ mm

16. The height of a ceiling is 300 cm. How many meters is that ?

_____ m

17. A rectangular table is 90 cm wide by 160 cm long. What is its perimeter ? _____ cm

18. In problem # 17 , what is the perimeter in meters ? _____m

19. How many meters of fencing are needed for a rectangular play area 1m wide by 22m long ? _____m

20. In problem 19 , what is the amount needed in centimeters ?

6.10.11 METRIC CONVERSIONS

INSTRUCTIONAL OBJECTIVES

PREREQUISITES	the student will be able to ...
4.10.11	recognize the equivalency of standard units of metric measure.
5.10.09	identify the root words and prefixes for metric measure.
5.10.10	write any standard metric unit in equivalent fraction and decimal notation; e.g., 1 cm = $\frac{1}{100}$ m = 0.01 m
NEW I.O.s	The student will be able to ...
6.10.11.01	convert larger metric units to equivalent smaller metric units by multiplying. e.g., 2 kg = (2 x 1000 g)= 2000 g 3 m = (3 x 100cm) = 300 cm 2 cℓ = (2 x 10 mℓ) = 20 mℓ
6.10.11.02	convert smaller metric units to equivalent larger metric units by dividing ; e.g., 4000 g = (4000 ÷ 1,000)= 4 kg 600 cm = (600 ÷ 100) = 6 m 70 mℓ = (70 ÷ 10) = 7 cℓ

10

6.10.11.03 convert larger metric units to equivalent smaller metric units by moving the decimal point to the right indicating multiplication by a power of 10.

e.g., 3 .0 m = 30 cm

6.28 l =62.8 cl = 628 cl

83.4 g = 834 dg = 8340 cg

6.10.11.04 convert smaller metric units to equivalent larger metric units by moving the decimal point to the left indicating division by a power of 10.

e.g., 324 cm = 32.4 dm = 3.24 m

6708 ml = 670.8 cl = 67.08 dl

= 6.708 l

8768 g = 876.8 dag = 87.68 hg =8.768 kg

CONVERTING TO SMALLER UNITS

Larger units to smaller units – multiply.

m = meter

km = kilometer **dm = decimeter**
hm = hectometer **cm = centimeter**
dam = dekameter **mm = millimeter**

1 m = 10 dm

kilo	hecto	deka	METER	deci	centi	milli

× 10

A meter is larger than a decimeter.
To convert meters to decimeters multiply by 10.

256 m _____ dm 19 m = _____ dm

1 m = 100 cm

kilo	hecto	deka	METER	deci	centi	milli

× 10 **× 10**

A meter is larger than a centimeter.
To convert meters to centimeters multiply by 100.

32 m _____ cm 5 m = _____ cm

1 km = 1000 m

kilo	hecto	deka	METER	deci	centi	milli

× 10 **× 10** **× 10**

Which is larger, a kilometer or a meter? _____
To convert kilometers to meters multiply by 1000.

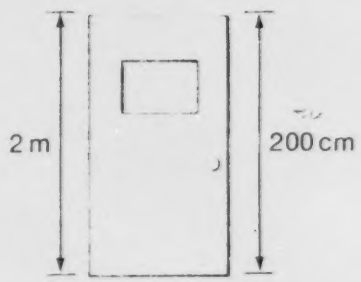
5 km = _____ m 24 km = _____ m

Make a rule for converting larger units to smaller units.

I. Convert to centimeters.

1. 1 m = _____ cm	**2.** 2 m = _____ cm
3. 3 m = _____ cm	**4.** 5 m = _____ cm
5. 8 m = _____ cm	**6.** 10 m = _____ cm
7. 15 m = _____ cm	**8.** 100 m = _____ cm
9. 83 m = _____ cm	**10.** 71 m = _____ cm
11. 1.3 m = _____ cm	**12.** 9.2 m = _____ cm
13. 4.6 m = _____ cm	**14.** 8.7 m = _____ cm
15. 2.63 m = _____ cm	**16.** 5.18 m = _____ cm
17. 43.2 m = _____ cm	**18.** 68.3 m = _____ cm
19. 27.65 m = _____ cm	**20.** 13.46 m = _____ cm

Suppose a door is 2 m high. If you measure it in centimeters, it is 200 cm high. Both measurements are the same.



Changing a unit from one form to another, keeping the same value, is called converting.

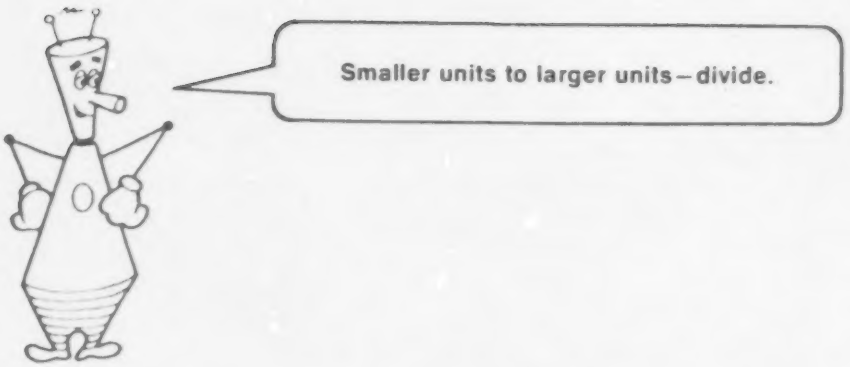
Sometimes you have to convert from meters to centimeters. Since 1 m = 100 cm, convert meters to centimeters by multiplying by 100.

Example: A rug is 3 m long. How many centimeters long is it?
3 m × 100 = 300 cm

Example: A refrigerator is 1.5 m high. How many centimeters high is it?
1.5 m × 100 = 150 cm

Example: 2.7 m = _____ cm
2.7 m × 100 = 270 cm

CONVERTING TO LARGER UNITS



1 dam = 10 m

kilo	hecto	deka	METER	deci	centi	milli

÷ 10

A meter is smaller than a dekameter.

To convert meters to dekameters divide by 10.

40 m _____ dam 400 m = _____ dam

1 m = 100 cm

kilo	hecto	deka	METER	deci	centi	milli

÷ 10 ÷ 10

Which is smaller, a centimeter or a meter? _____

To convert centimeters to meters, divide by 100.

800 cm _____ m 80,000 cm = _____ m

1 m = 1000 mm

kilo	hecto	deka	METER	deci	centi	milli

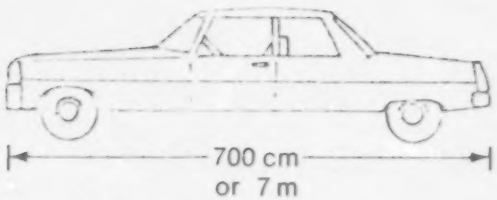
÷ 10 ÷ 10 ÷ 10

To convert millimeters to meters divide by 1000.

6000 mm _____ m 60,000 mm = _____ m

Make a rule for converting smaller units to larger units.

Sometimes you have to convert centimeters to meters. Suppose a car is 700 cm long. It is also 7 m long. Both measurements are the same.



Since 100 cm = 1 m, convert centimeters to meters by dividing by 100.

Example: On a baseball diamond, first base is approximately 2800 cm from home plate. How many meters from home plate is first base?
2800 cm ÷ 100 = 28 m

Example: Chris is 182 cm tall. How tall is Chris, measured in meters?
182 cm ÷ 100 = 1.82 m

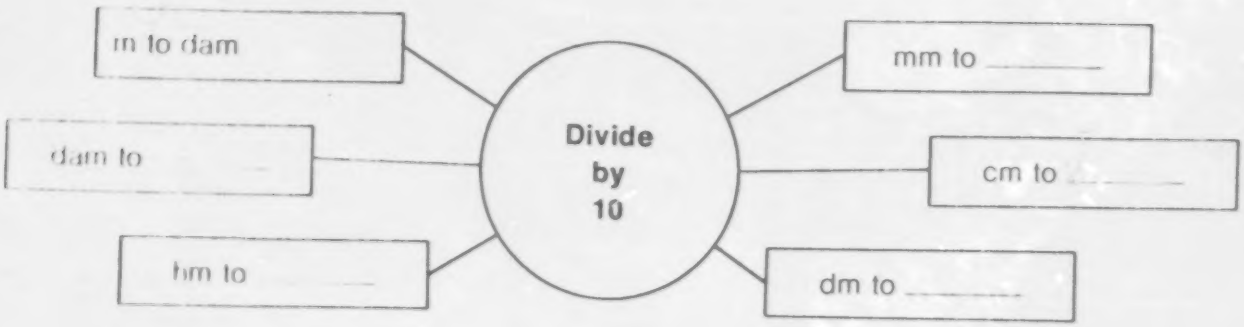
Example: 836 cm = _____ m
836 cm ÷ 100 = 8.36 m

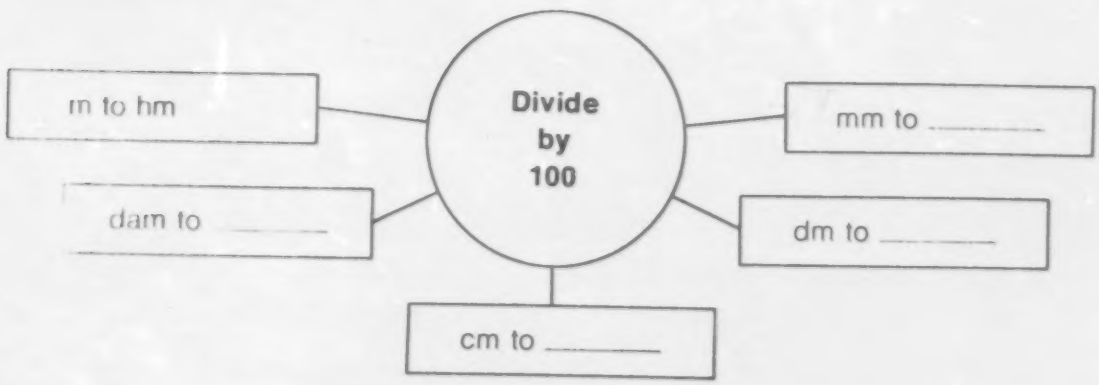
Convert to meters.

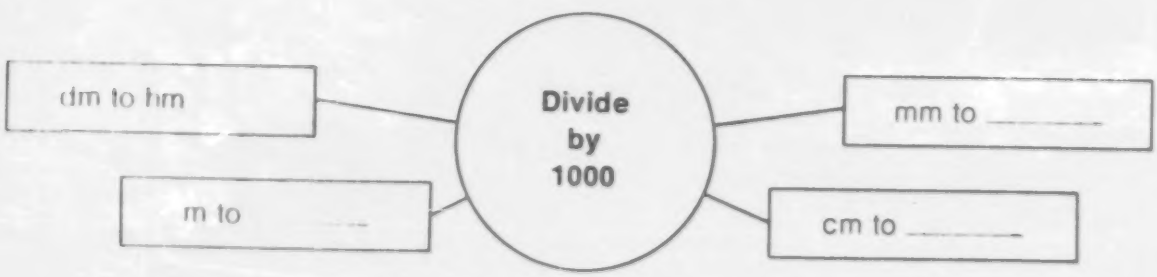
1. 100 cm = _____ m
2. 400 cm = _____ m
3. 700 cm = _____ m
4. 900 cm = _____ m
5. 1800 cm = _____ m
6. 4300 cm = _____ m
7. 550 cm = _____ m
8. 225 cm = _____ m
9. 368 cm = _____ m
10. 923 cm = _____ m
11. 1238 cm = _____ m
12. 4012 cm = _____ m
13. 7861 cm = _____ m
14. 5083 cm = _____ m
15. 91,000 cm = _____ m
16. 83,465 cm = _____ m
17. 50 cm = _____ m
18. 10 cm = _____ m
19. 83 cm = _____ m
20. 45 cm = _____ m

CONVERTING

Convert the units in the boxes by following the rule in the circle.





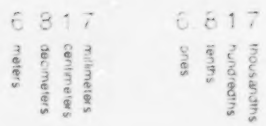


Convert

from	dm	cm	mm	mm	m	dam	cm	m	hm	dm	dam	dm
to	dam		m	dm		km	dam		km		hm	m
divide by		10			100			1000		10		

A CONVERTING SHORTCUT

Look at the decimal numeral 6.817. You know that 6 is the number of ones, 8 is the number of tenths, 1 is the number of hundredths, and 7 is the number of thousandths.



Decimal numerals in the metric system work the same way. If 6.817 is a measurement of meters, then 6 is the number of meters, 8 is the number of tenths of a meter or decimeters, 1 is the number of hundredths of a meter or centimeters, and 7 is the number of thousandths of a meter or millimeters. 6.817 m is 6 m 8 dm 1 cm 7 mm.

You have learned to convert meters, centimeters, millimeters, and kilometers. Since the metric system is a decimal system, you can convert from one unit to another by multiplying or dividing by 10 or a power of 10. Remember, to convert larger units to smaller units, you multiply. To convert smaller units to larger units, you divide.

A shortcut you can use when converting in the metric system is to move the decimal point and change the unit name.

Moving the decimal to the right means multiply

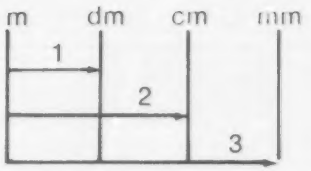
1 place to the right ..... × 10
2 places to the right ..... × 100
3 places to the right ..... × 1000

Moving the decimal to the left means divide

1 place to the left ..... ÷ 10
2 places to the left ..... ÷ 100
3 places to the left ..... ÷ 1000

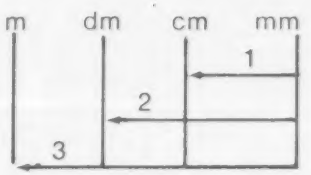
Convert 9.421 m to cm. Think: Convert large to small—multiply. Cm is *2 places* to the *right* of m. Move the decimal point *2 places* to the *right* (× 100) and call the measurement cm.

$$9.421 \text{ m} = 942.1 \text{ cm}$$



Convert 612 mm to cm. Think: Convert small to large—divide. Cm is *1 place* to the *left* of mm. Move the decimal point *1 place* to the *left* (÷ 10) and call the measurement cm.

$$612 \text{ mm} = 61.2 \text{ cm}$$



Note: You do not see a decimal point in the numeral 612. That means the decimal point is at the far right.

If you want to add or subtract measurements, they must be expressed in the same unit. Now you can convert units by moving the decimal point.

Example: Add 3.21 m + 143 cm. Express the answer in meters.

3.21 m is expressed in meters.
But you must convert 143 cm to m.
143 cm = 1.43 m
Now you can add.

$$\begin{array}{r} 3.21 \text{ m} \\ +\ 1.43 \text{ m} \\ \hline 4.64 \text{ m} \end{array}$$

Example: Which measurement is greater: 51.2 cm or 484 mm?

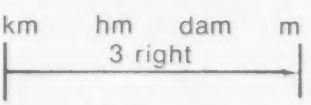
1) 484 mm = 484. mm
= 48.4 cm

2) 51.2 cm = 51.2 cm
= 512 mm

51.2 cm is greater than 48.4 cm.
512 mm is greater than 484 mm.

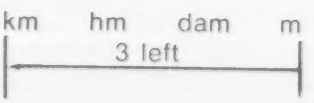
To change kilometers to meters, move the decimal point 3 places to the right.

$$1.5553 \text{ km} = 1.555\,3 \text{ km}$$
$$= 1555.3 \text{ m}$$



To change meters to kilometers, move the decimal point 3 places to the left.

$$3155 \text{ m} = 3155. \text{ m}$$
$$= 3.155 \text{ km}$$



I. Complete the following.

1. 22 m = _____ cm
2. 65 mm = _____ cm
3. 105 mm = _____ cm
4. 14 mm = _____ cm
5. 3.1 cm = _____ mm
6. 2.4 cm = _____ mm
7. 6.5 cm = _____ mm
8. 12.8 cm = _____ mm
9. 105 cm = _____ m
10. 145 cm = _____ m
11. 123 cm = _____ m
12. 1034 cm = _____ m
13. 1.52 m = _____ cm
14. 1.35 m = _____ cm
15. 10.20 m = _____ cm
16. 2.05 m = _____ cm
17. 1400 m = _____ km
18. 4.315 km = _____ m
19. 6200 m = _____ km
20. 2.655 km = _____ m
21. 1297 mm = _____ cm = _____ dm = _____ m
22. 3006 mm = _____ cm = _____ dm = _____ m
23. 458 mm = _____ cm = _____ dm = _____ m
24. 9.082 m = _____ dm = _____ cm = _____ mm
25. 0.114 m = _____ dm = _____ cm = _____ mm

II. Circle the longest unit.

1. 10 mm 0.9 cm 9 mm
2. 22 mm 2.2 cm 23 mm
3. 31 cm 300 mm 30 cm
4. 1.4 cm 15 mm 1.3 cm
5. 114 cm 1.2 m 110 cm
6. 130 cm 1.42 m 170 cm
7. 1.35 m 120 cm 1.4 m
8. 2.68 m 200 cm 2 m
9. 2000 m 3 km 2500 m
10. 1781 m 1.8 km 1500 m

6.10.12 LINEAR MEASUREMENT - CIRCLES

INSTRUCTIONAL OBJECTIVES

PREREQUISITES	The student will be able to...
5.10.11	master all I.O.'s in the module:
	find the area of rectangles using metric units of measure.
	add and subtract linear measures with regrouping.

NEW I.O.s	The student will be able to...
6.10.12.01	compute the diameter of a circle given the radius, using the equation $d = 2r$ (using metric units).
6.10.12.02	compute the radius of a circle given its diameter, using the equation $r = \frac{1}{2} d$ or $r = \frac{d}{2}$

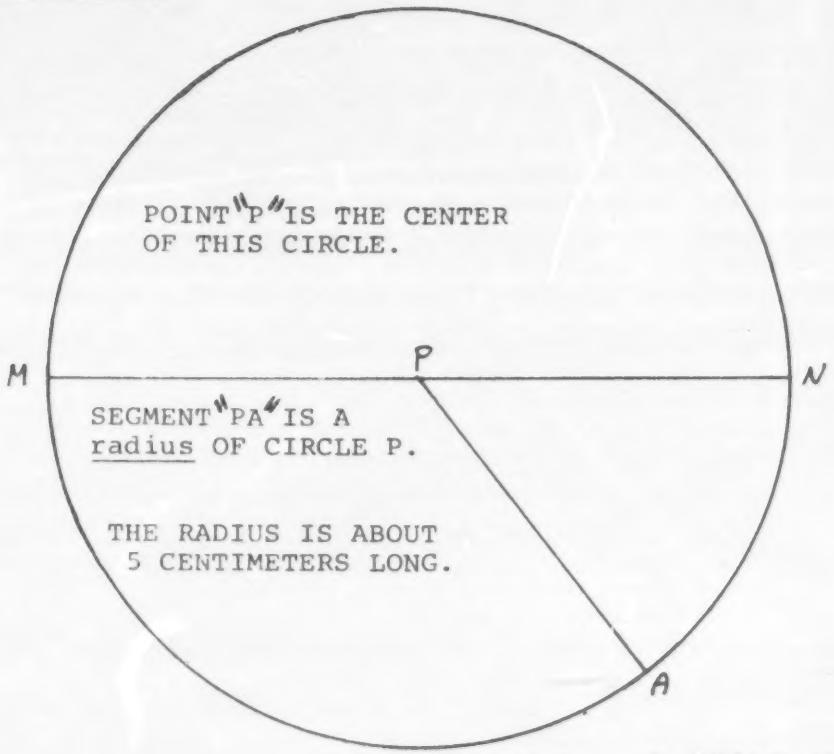
10

6.10.12.03 compute the circumference of a circle given its radius or its diameter using the equations $c = \pi d$ or $c = 2\pi r$ (use metric units)

6.10.12.04 compute the area of a circle given its radius, using the equation $A = \pi r^2$ (use metric units)

10

PARTS OF A CIRCLE



IF YOU SET YOUR COMPASS AT 5 CM AND DRAW A CIRCLE, IT WILL HAVE A DIAMETER OF 10cm.

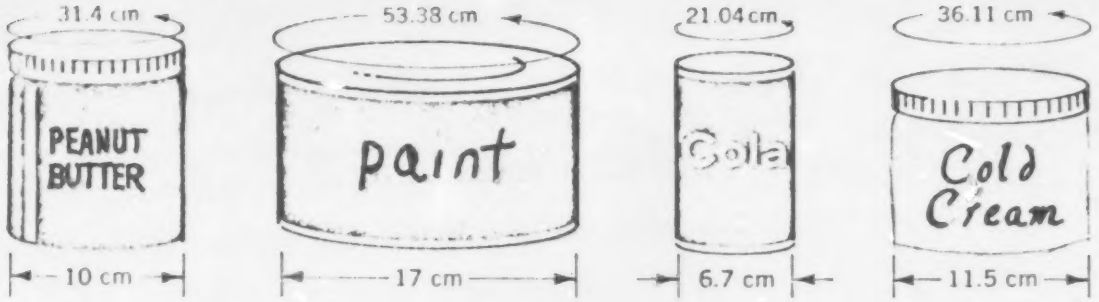
SEGMENT "MN" IS A DIAMETER OF CIRCLE P.

1. DRAW A CIRCLE WITH A 2cm radius. HOW LONG IS THE DIAMETER ?

2. DRAW A CIRCLE WITH A 6 cm DIAMETER. HOW LONG IS THE RADIUS? LABEL THE CENTER WITH THE LETTER "A." DRAW SIX RADII. LABEL THEM AB, AC, AD, AE, AF, AND AG.

3. COMPLETE THE TABLE.

CIRCLE	DIAMETER	RADIUS
J	6 CM	
K	4 CM	
L		2.5 CM
M		3.3 CM



The **diameter** is the longest distance across a circle.

The **circumference** of a circle is the distance around it (perimeter).

A. What is the diameter of each of the circular containers shown above?

B. What is the circumference of each of the circular containers shown above?

C. Complete the table for each container.

	Peanut Butter	Paint	Cola	Cold Cream
Circumference (C)	31.4 cm			
Diameter (*d*)	10 cm	17 cm		
3.14 × *d*				

D. Study the results of your work in exercise C. Compare circumference and 3.14 × d.

How might you find the circumference of a circle with a diameter of 12 centimeters?

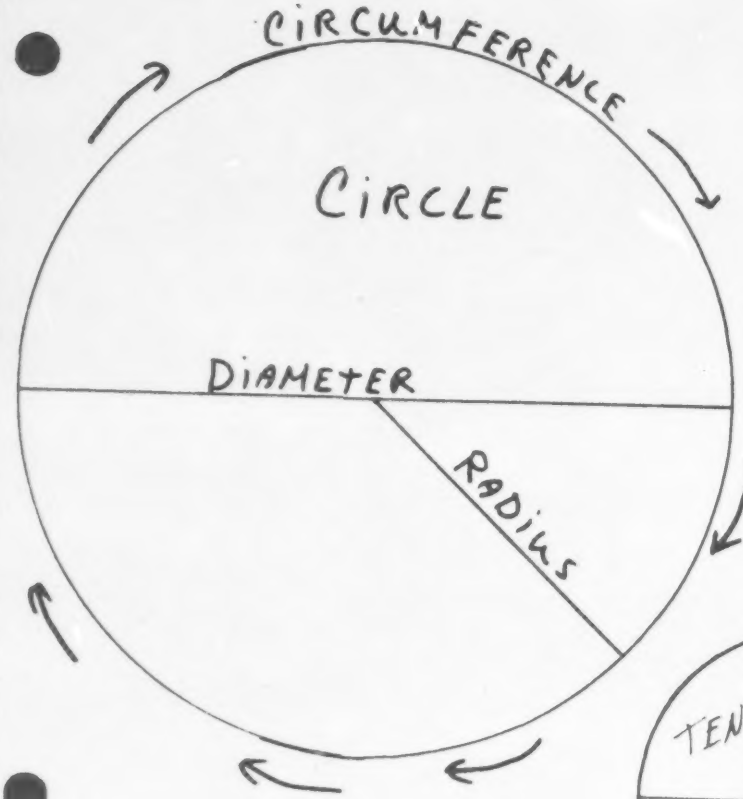
E. A very important number in mathematics is called pi (π). It equals approximately 3.14.

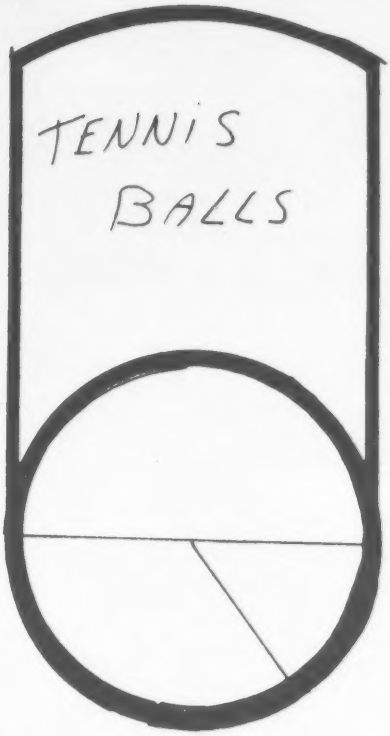
$$\pi \approx 3.14$$

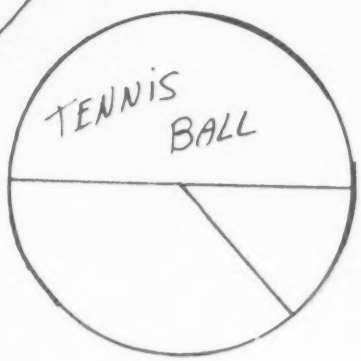
F. Pi (π) relates the diameter and the circumference of *every* circle.

For every circle:

$C = \pi d$ or $C = 2\pi r$







CIRCUMFERENCE

THE CIRCUMFERENCE OF A CIRCLE IS THE DISTANCE AROUND THE CIRCLE.

The circumference of the lid is about 24 centimeters.

The circumference of the tennis ball is about 21 centimeters

The circumference of the can is about 23 centimeters

TO MEASURE EACH OF THE FOLLOWING, WHICH WOULD YOU FIND - THE CIRCUMFERENCE, THE DIAMETER , OR THE RADIUS ?

1. The distance from each horse to the center of a merry-go-round ? _____
2. The distance around a globe on the equator ? _____
3. The distance across the center of a free-throw circle on a basketball court ? _____
4. The length of a rope that fits around a tree ? _____

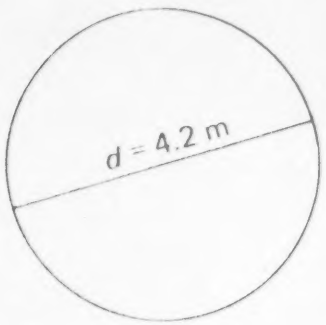
I.O. 6.10.12.03

Circumference of a Circle

name _____

Find the circumference.
Use 3.14 for π. $C = \pi d$ $C = 2\pi r$

1.



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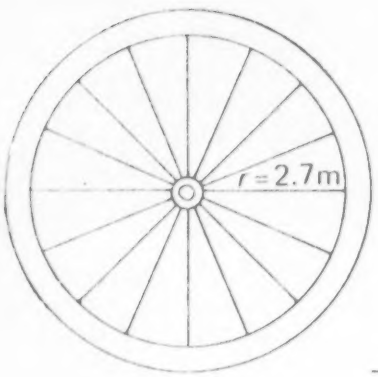
2.



_____

3. r = 9 m _____

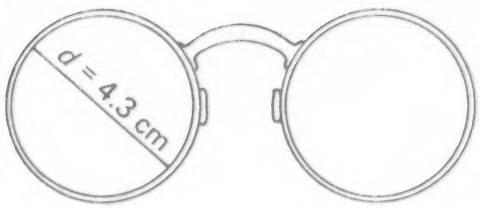
4. r = 11.2 cm _____

5. r = 7.8 m _____

6.

_____

7.



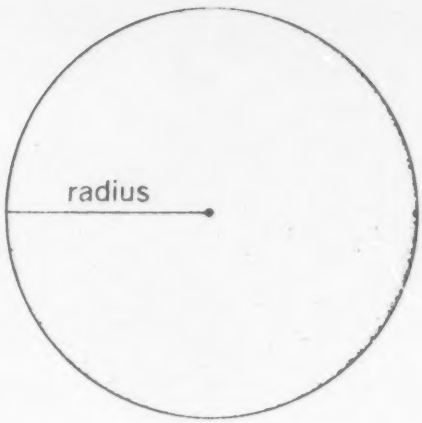
_____

8. d = 91 cm _____

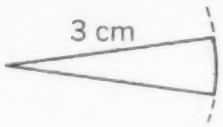
9. d = 3.6 m _____

10. d = 8.6 cm _____

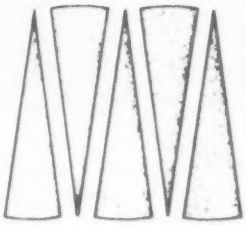
A. Draw a circle on a piece of paper. Make the radius 3 centimeters long.



B. Cut out the circle. Then cut it into pieces, like this.

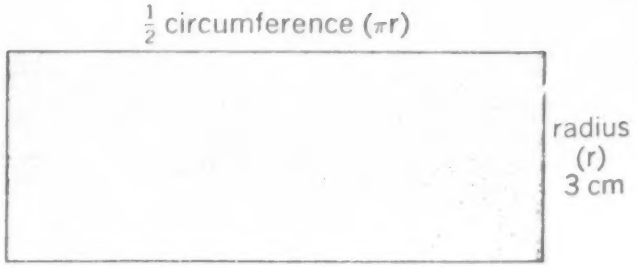


C. Fit the pieces (sectors) together, like this.



D. If we could cut the pieces small enough, they would fit into this rectangle.

How would you find the area of that rectangle?

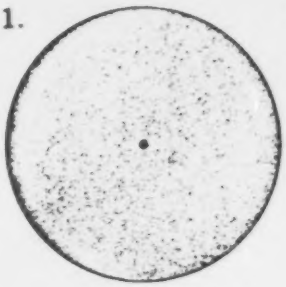


E. Here is the formula for finding the area of any circle.

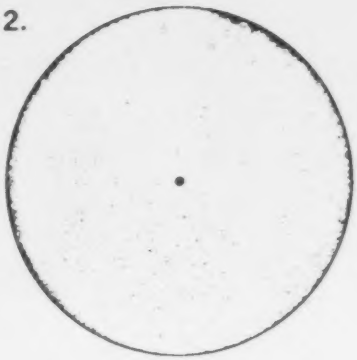
$$A = \pi(r \times r) = \pi r^2 \quad (\pi \approx 3.14)$$

F. Measure to find the area of these circles.

1.

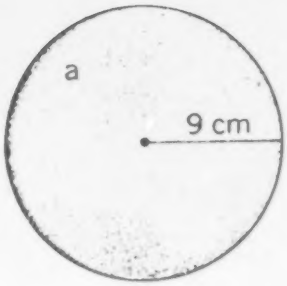


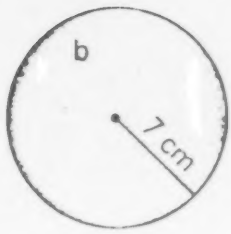
2.



ON YOUR OWN

1. What are the areas of these circles?

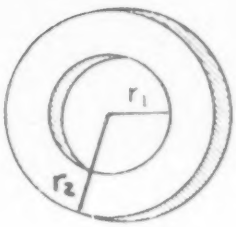




2. Complete the table.
Rule: $A = \pi r^2$

	a	b	c	d	e
radius (r)	6 cm	12 m	24 mm	1.8 cm	9.3 km
Area (A)					

3. What is the area of the washer? (Do not count the hole.)



r_1: 9mm
r_2: 1.5cm

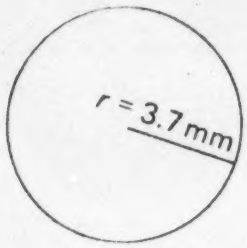
BRAIN BUILDER

Draw a circle that has an area of 78.5 square centimeters.

Area of a Circle

name _____

Find the area.
Use 3.14 for π. $A = \pi r(r)$ $A = \pi r^2$

1. 

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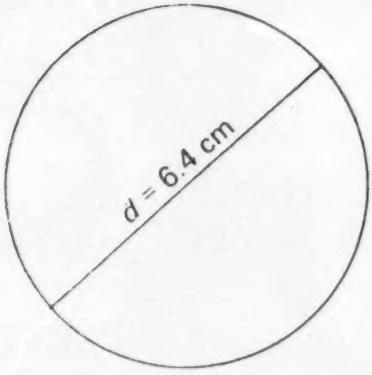
2. 

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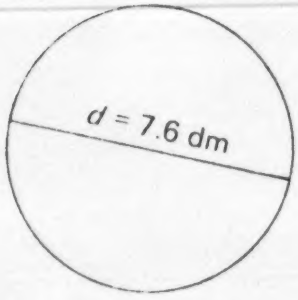
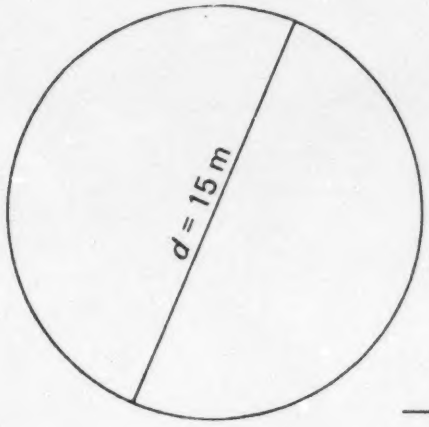
3. 

_____

4. r = 2.6 mm _____

5. r = 9 m _____

6. 

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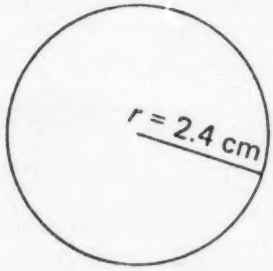
7. 

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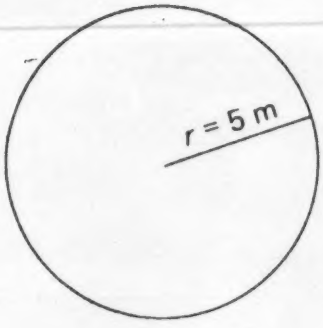
8. 

_____

9. d = 4.3 cm _____

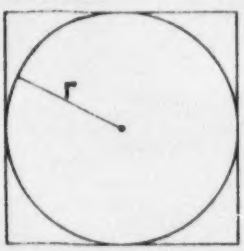
10. d = 8.6 m _____

1. For each radius or diameter, find the area of the circle. Use $3\frac{1}{7}$ for π.

a. $d = 4$ cm.
b. $d = 24$
c. $r = 5$ yd.
d. $d = 50$ ft.
e. $r = 1\frac{1}{2}$ m.
f. $d = 42$ in.
g. $r = 7\frac{1}{2}$ cm.
h. $d = 28$ m.
i. $r = 17$ in.

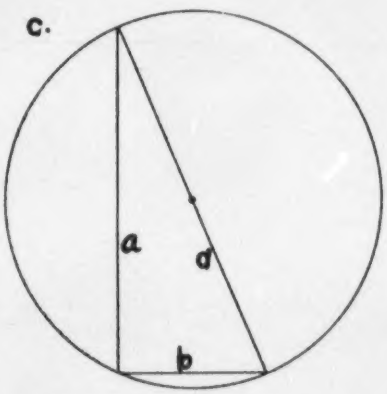
2. Find the area of the shaded part of each figure. Use 3.14 for π.

a.



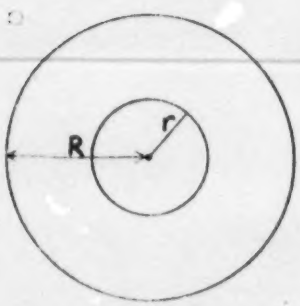
$r = 4$ cm.

c.



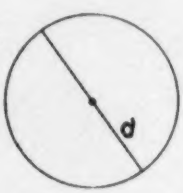
$a = 12$ cm., $b = 5$ cm., $d = 13$ cm.

b.



$R = 5$ cm., $r = 2$ cm.

d.



$d = 6$ cm.

3. Mr. and Mrs. Dougherty put tile on the bottom of their circular swimming pool, which measures 10 ft. across. They used small tiles that are 3 inches square. How many tiles did they use?

6.10.13 LINEAR MEASUREMENT - SCALE DRAWINGS

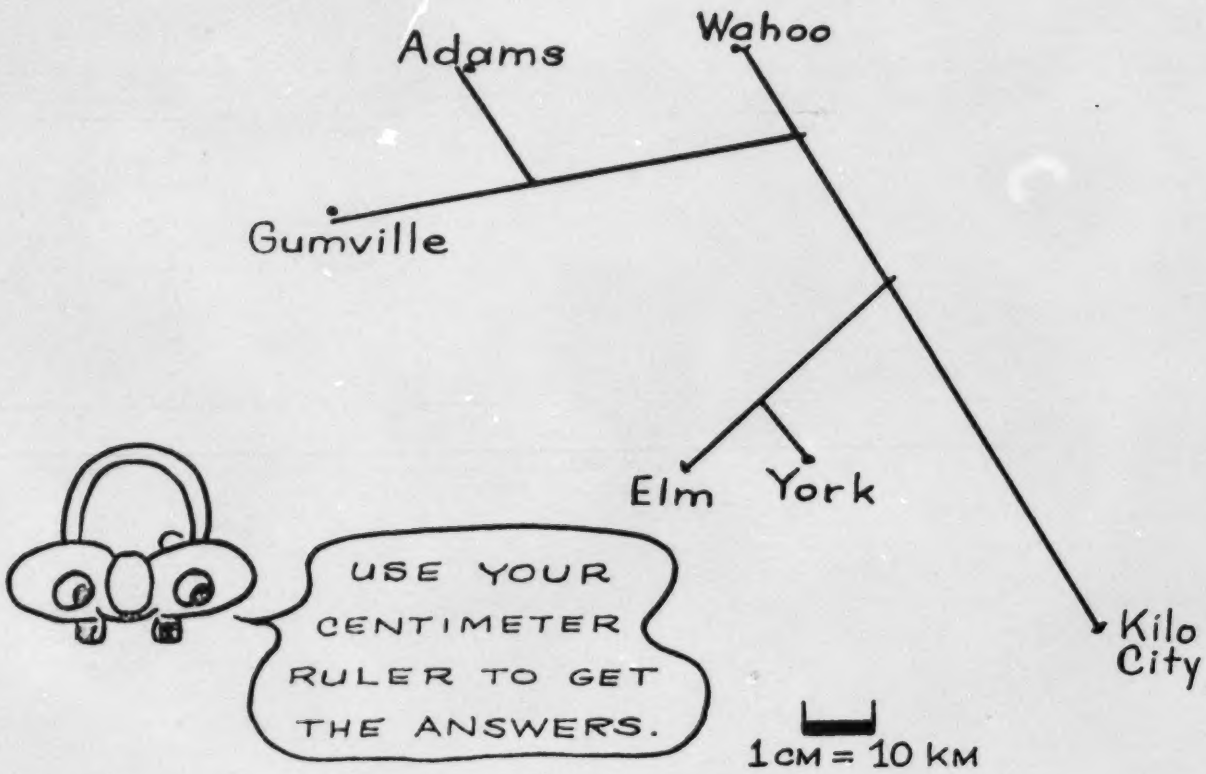
INSTRUCTIONAL OBJECTIVES

PREREQUISITES	The student will be able to...
6.10.11	Master all I.O.'s convert larger or smaller metric units to equivalent metric units.

NEW I.O.'s	The student will be able to...
6.10.13.01	interpret scale drawings using metric units. e.g., 1 cm = 1m 1 cm = 1km
6.10.13.02	solve story problems related to scale drawings.

10

LET'S GO PLACES



1. One cm = _____ km.
2. One-half centimeter = _____ kilometers.
3. A drive from Wahoo to Kilo City is ____ km.
4. The road from Kilo City to Gumville is ____ km.
5. Adams to Gumville is _____ km.
6. Elm to Gumville is _____ km.
7. Elm to York and back again. _____ km
8. Which is closer to Wahoo – Adams or Gumville ? _____

I.O. 6.10.13.01

M-18b-

Let's Practice

Find the distances on the map by measuring with your metric ruler. Use a scale of 1 centimeter for 200 kilometers.

	cm	km
1. Los Angeles to New York	_____	_____
2. Phoenix to Detroit	_____	_____
3. Kansas City to Atlanta	_____	_____
4. Dallas to Seattle	_____	_____
5. San Francisco to Boise to Chicago (total)	_____	_____
6. Denver to Miami to New York (total)	_____	_____

U.S. CITY DISTANCES

Determine and record the distances between the following cities:

Los Angeles to Denver _____ km

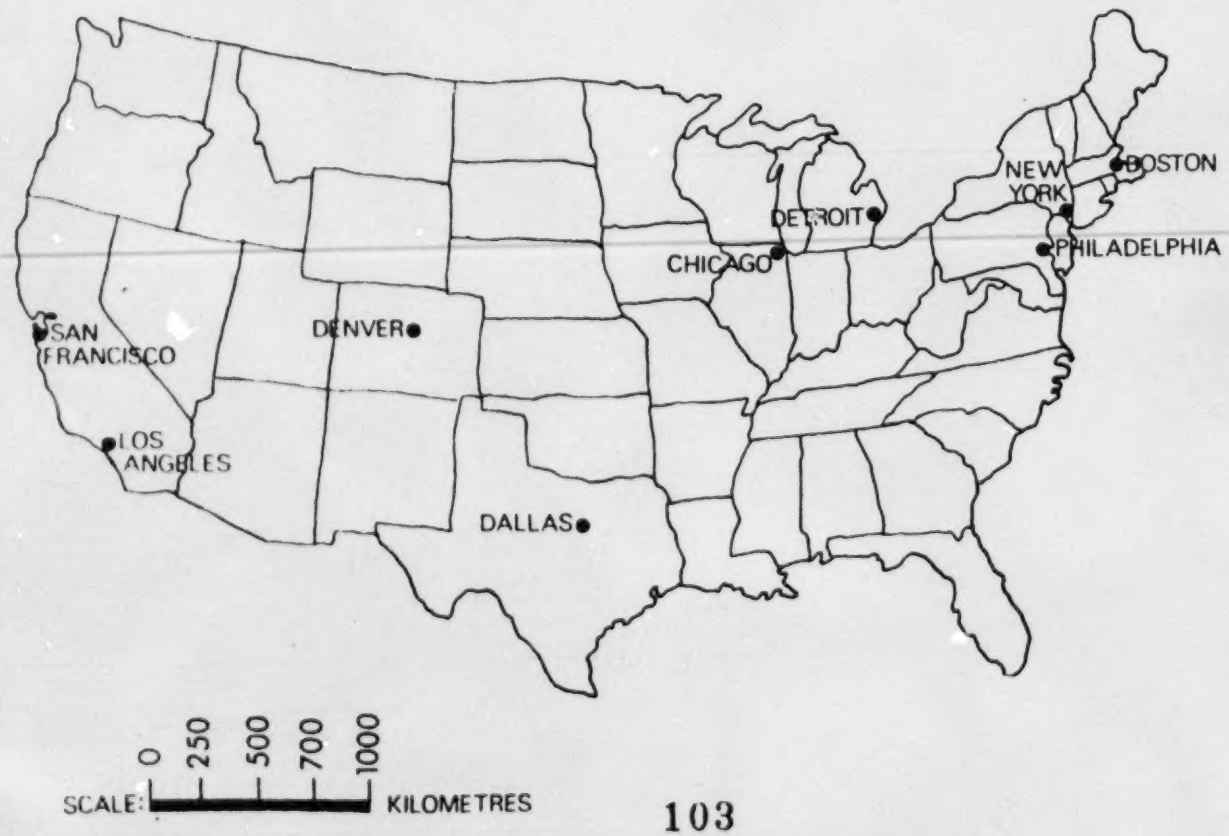
Chicago to Detroit _____ km

Dallas to Philadelphia _____ km

Boston to Chicago _____ km

Los Angeles to New York _____ km

Note: Kilometre is pronounced with the accent on the first syllable.



Working with Kilometres

MATERIALS
centimetre ruler

1. From the map, find the approximate distances in kilometres "as the crow flies" between these cities.
   - **a.** St. John's and Halifax _____
   - **b.** Charlottetown and Montreal _____
   - **c.** Toronto and New York _____
   - **d.** Winnipeg and Chicago _____
   - **e.** Edmonton and Vancouver _____
   - **f.** Seattle and San Francisco _____
   - **g.** Boston and Detroit _____
   - **h.** Vancouver and Halifax _____

2. Find the approximate distance from Halifax to Chicago
   - **a.** by way of Montreal. _____
   - **b.** by way of New York. _____
   - **c.** by way of Toronto. _____
   - **d.** by way of Detroit. _____

3. About how many kilometres farther is the distance "as the crow flies" from Winnipeg to Vancouver than the distance from Halifax to New York? _____

1.10.12 CAPACITY

INSTRUCTIONAL OBJECTIVES

PREREQUISITES

None

NEW I.O.s — The student will be able to...

1.10.12.01 define and compare in non-standard terms

a) full, half full, empty

b) most, least

c) jarful, glassful (use of any containers)

10

ACTIVITY

1.10.12.01 define and compare in non-standard terms

a) full, half full, empty

b) most, least

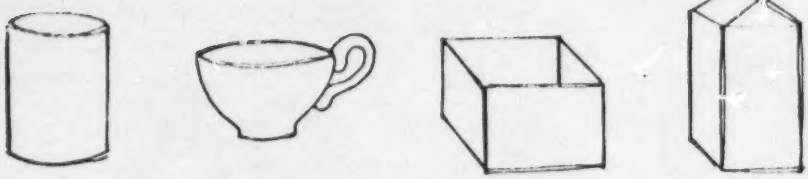
c) jarful, glassful (use of any containers)

METHOD

Present the following activities orally, if the children are unable to read them.

10

Which holds the most sand?



My guess is _____

With the small scoop fill each container with sand.

Count the scoopfuls.

The tin can holds _____ scoopfuls.

The cup holds _____ scoopfuls.

The box holds _____ scoopfuls.

The milk carton holds _____ scoopfuls.

Which holds the most?

_____

Which container is the biggest?

_____

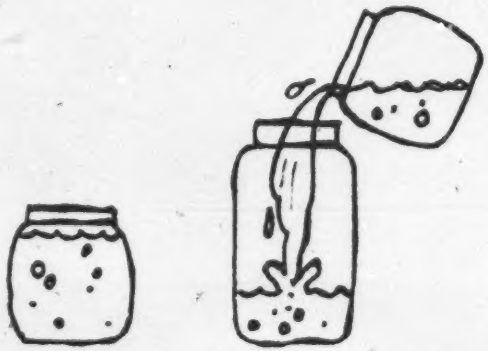
1

Get 3 jars of different size and shape.

Fill one with water. Pour the water into the other jars.

Find which one holds the most.

2 Fill the jar that holds the least with water.



Pour the water from this jar into 1 of the other jars.

Is the water level the same as in the first jar ?

I.O. 1.10.12.01

3

Number the jars by how much they hold:

1 holds the least, 3 the most.

____ ____ ____

4 Get a fourth jar, pot or cup different from the others.

Does it hold more, less or the same as any of the others ?

Number it by how much it holds. Do you have to change the number of any of the other jars ?

M-19c--

1.

Do all cups hold the same amount ?

Get 5 cups or mugs of different size and shape.

Work out a way of telling how much water each holds. (capacity)

2.

Here is 1 way:

Take another small measure like an

egg cup or a spoon

and see how many times it takes to fill each cup.

Did you think of another way ?

3.

Estimate which cup holds the least and which holds the most.

Mark the cup that holds the least number 1 and the one with the most, number 5 .

____ ____ ____ ____ ____

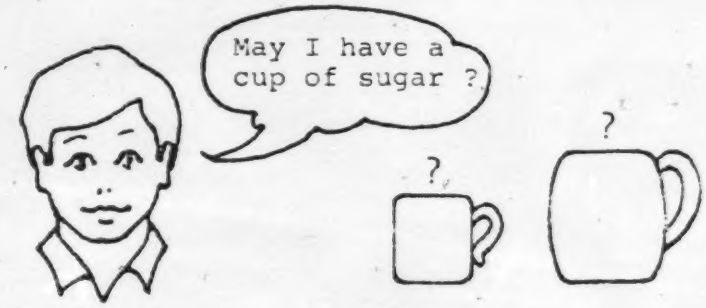
Use the egg cup to fill each cup. See how many times it takes to fill each one.

Write the numbers.

How good were your estimates ?

4.

If you were asked to measure a cup of something, the amount would be different with each cup of different size.



We need a unit that is always the same so the same amount can be measured.

2.10.12 CAPACITY

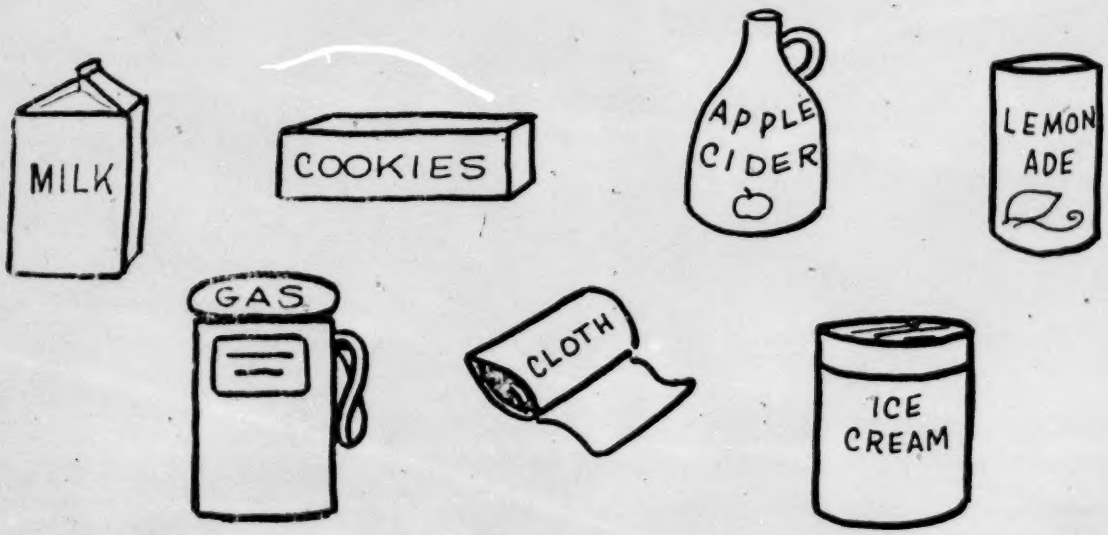
INSTRUCTIONAL OBJECTIVES

PREREQUISITES	The student will be able to...
1.10.12	master all I.O.'s in the module.
	define and compare in non-standard terms full, half full, empty, most, least.
NEW I.O.s.	The student will be able to...
2.10.12.01	compare the capacity of similar shaped containers for dry or liquid amounts as to more, less, and the same or equal.
2.10.12.02	recognize the liter (ℓ) as a basic unit of capacity measure. Recognize the abbreviation for liter is ℓ.

10

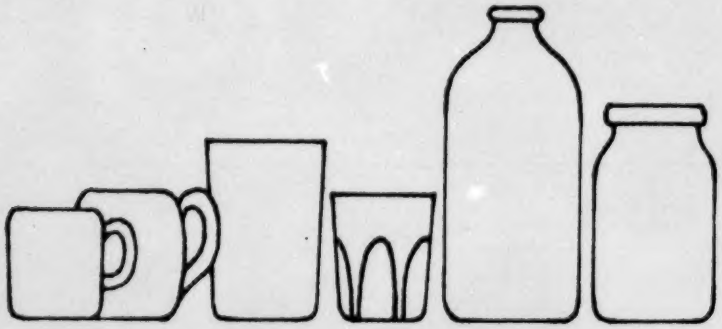
One pail holds 1 liter of water.
Five pails hold _____ liters of water.
Color the picture.

Circle the things we buy in liters:

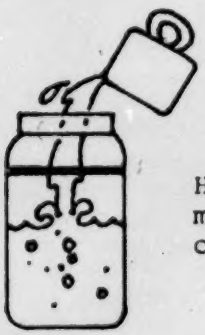


I.O. 2.10.12.02

Get 2 cups, 2 glasses and 2 bottles.



See how many of each it takes to make a liter.



How many cups ?

First make a guess then measure the number.

Guess any part of whole numbers.

1 liter

Draw each cup, glass and bottle and write the number on it.

How good were your guesses ?

3.10.12 CAPACITY

INSTRUCTIONAL OBJECTIVES

PREREQUISITES — The student will be able to...

recognize the liter as a basic unit of capacity measure.

NEW I.O.s — The student will be able to...

3.10.12.01 identify familiar amounts that approximate the capacity of one liter.

3.10.12.02 estimate and measure capacity in liters of various shaped containers.

3.10.12.03 solve story problems related to the above I.O.'s.

10

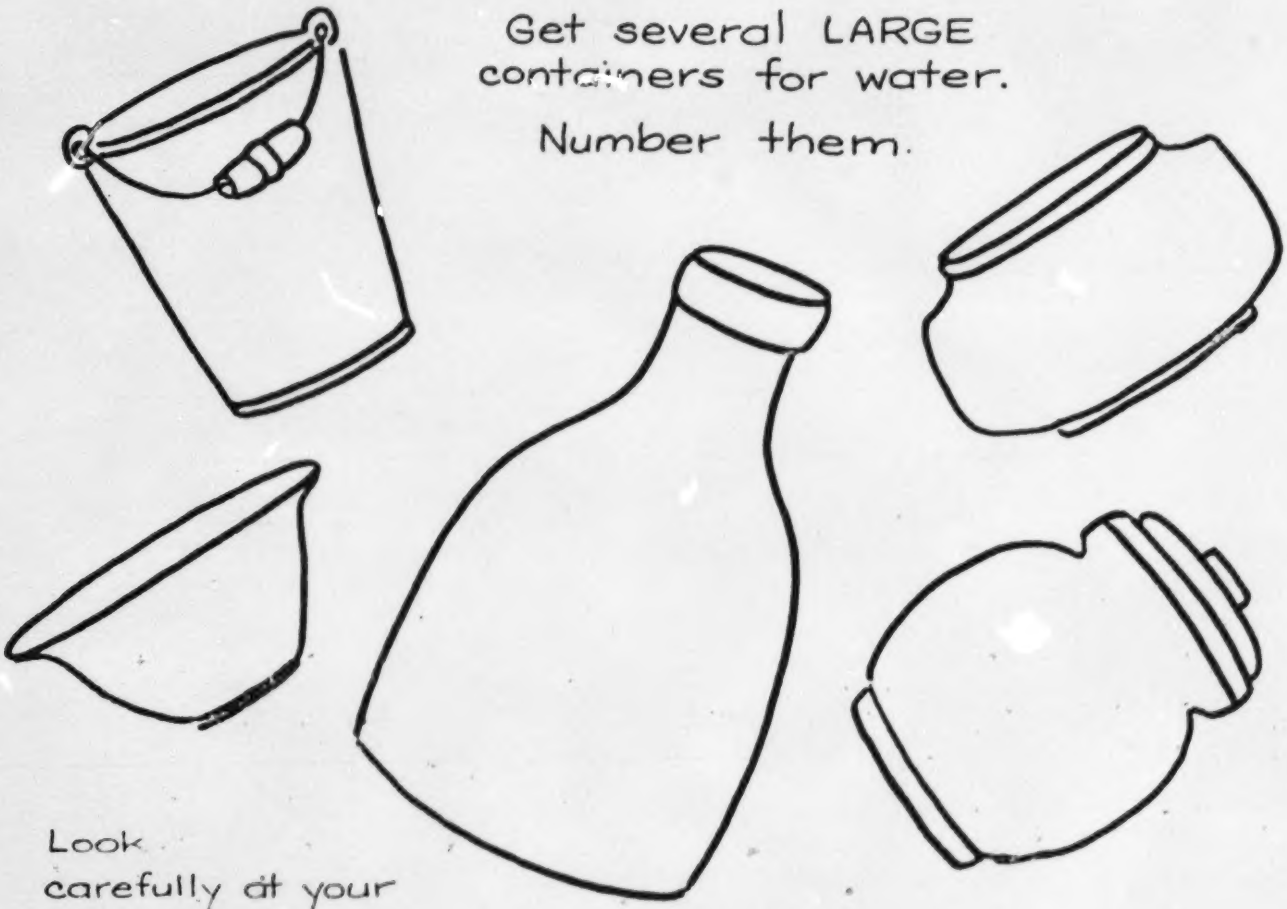
It holds 1 liter
of water.

Color the things that would hold at least 1 liter.

LOTS of LITERS

Get several LARGE containers for water.

Number them.



Look carefully at your liter measure.
Then ESTIMATE how many liters you think each container will hold.

Write your guesses here.

1. _____ liters	4. _____ liters
2. _____ liters	5. _____ liters
3. _____ liters	6. _____ liters

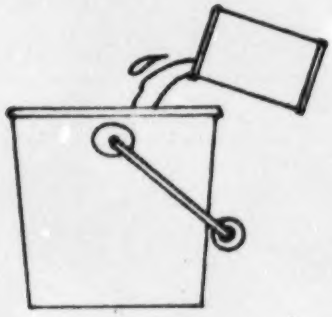
Now check your guesses with your liter measure. Circle your closest guess.

1

Get a wash pail or bucket.

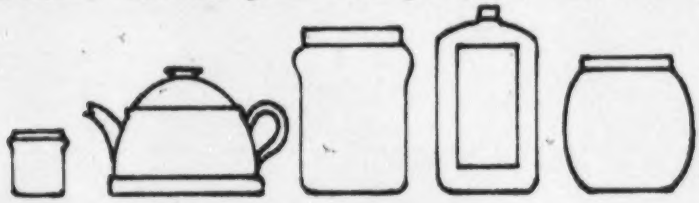
Estimate its capacity in liters. (Remember, capacity is the amount a container can hold.)

Use your liter can. Measure it.



2

Get 5 different empty containers that hold water, like: poster paint bottle, detergent bottle, coffee jar, tea pot, and so on.



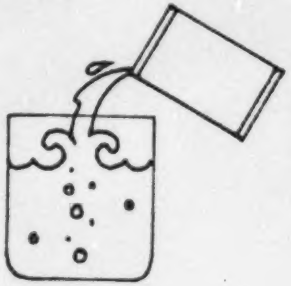
Estimate if each one holds a liter of water. Measure them.

How can you check your estimates and your measures ?

1

Get 6 different size empty cans.

Estimate which ones hold more or less or the same as a liter.



Now measure them.

Draw the cans and mark them more, less or same.

If they are less see how many times you need to fill them to make 1 liter.

If they are more see if they hold 2 liters.

2 Get some pots for cooking.

Do the same with the pots as you did with the cans.

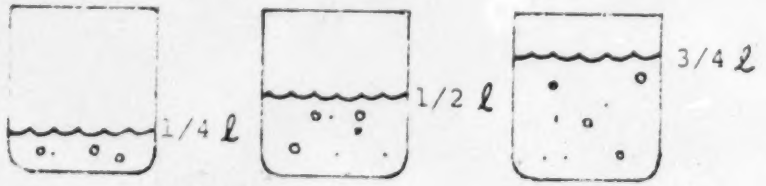
3

Get 3 different size milk cartons.

Guess if each one holds more or less than 1 liter.

Use your liter can and measure them.

If a carton holds less, estimate what part of a liter it holds.



Mark each carton with how much it holds (its capacity).

4

Find how many liters of milk your family drinks a day. How many in a week ?

A cow gives about 9 liters of milk a day. How long will that keep your family in milk ?

I.O. 3.10.12.02

M-21d-

THE LITER IN THE CLASSROOM

Let's use our liter to measure how much sand these containers hold. Make an estimate first.

Objects	My Estimate	It is
Big Can	_____ liters.	_____ liters.
Jam Jar	_____ liters.	_____ liters.
Big Milk Carton	_____ liters.	_____ liters.
Small Milk Carton	_____ liters.	_____ liters.

Now let's measure liquids. Take some plastic wrap and put it around the inside of your liter measurer. Go to the water center and find out how many liters of water these containers hold. Estimate first. Then fill each one to the top and empty with the liter measurer.

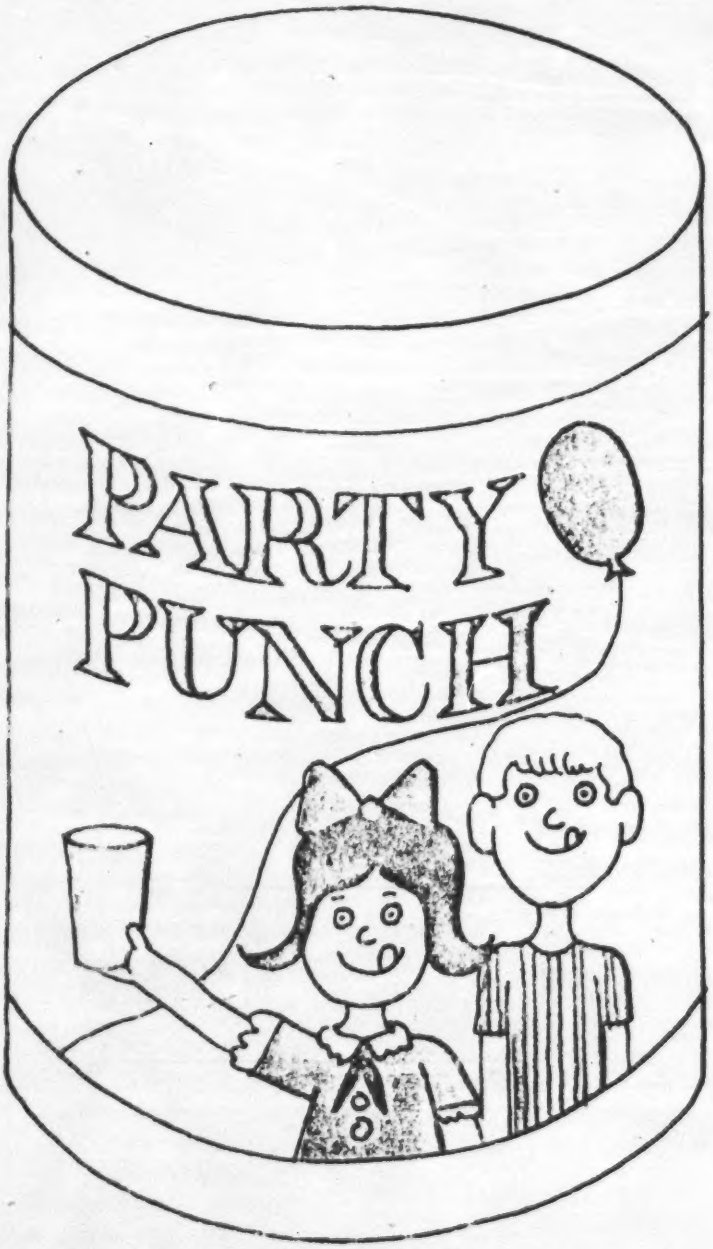
Objects	My Estimate	It is
Kettle	_____ liters.	_____ liters.
Bucket	_____ liters.	_____ liters.
Milk Container	_____ liters.	_____ liters.
Jam Jar	_____ liters.	_____ liters.
Tin Can	_____ liters.	_____ liters.
Bowl	_____ liters.	_____ liters.

Which container has the most ? _____ The least ? _____

What is the difference ? _____ liters.

DAVID'S SCOUT TROOP

David's scout troup was having a party. Fourteen people came. David bought 5 cans of Party Punch in cans just like the one in the picture. Each can was marked "1 ℓ." One liter of punch is enough to serve 6 people.



1. How many people can be served from 5 cans of Party Punch?

____

2. Could everyone at the party have a second serving of Party Punch?

____